Express5800/320Ma: PCI Adapter Guide

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Preface

Purpose of This Manual

The *Express5800/320Ma: PCI Adapter Guide* describes the PCI adapters used in Express5800/320Ma systems. The guide contains information specific to each adapter, including hardware and software requirements, cabling specifications, and configuration and troubleshooting guidelines.

Audience

This manual is intended for anyone who installs, configures, replaces, or troubleshoots PCI adapters on Express5800/320Ma systems.

Notation Conventions

This document uses the notation conventions described in this section.

Warnings, Cautions, and Notes

Warnings, cautions, and notes provide special information and have the following meanings:

W A R N I N G

A warning indicates a situation where failure to take or avoid a specified action could cause bodily harm or loss of life.

C A U T I O N

A caution indicates a situation where failure to take or avoid a specified action could damage a hardware device, program, system, or data.

N O T E

A note provides important information about the operation of a system.

Typographical Conventions

The following typographical conventions are used in Express5800/320Ma system documents:

- The bold font emphasizes words in text or indicates text that you type, the name of a screen object, or the name of a programming element. For example:

  Before handling or replacing system components, make sure that you are properly grounded by using a grounded wrist strap.

  In the **System Properties** dialog box, click the **Hardware** tab.

  Call the **RegisterDeviceNotification** function.

- The italic font introduces new terms and indicates programming and command-line arguments that the user defines. For example:

  Many hardware components are *customer-replaceable units* (CRUs), which can be replaced on-site by system administrators with minimal training or tools.

  copy *filename1 filename2*

  Pass a pointer for the *NotificationFilter* parameter

- The monospace font indicates sample program code and output, including message text. For example:

  ```
  #include <iostream.h>

  The operation completed successfully.
  ```

Getting Help

If you have a technical question about Express5800/320Ma hardware or software, try these online resources first:

- **Online support from NEC Technical Support.** You can find the latest technical information about an Express5800/320Ma through online product support at the NEC Technical Support Web site:

  http://support.necsam.com/servers/

- **Online product support for Microsoft® products**. Your primary source for support is the computer manufacturer who provided your software, or an authorized Microsoft Support Provider. You can also find the latest technical information about Microsoft Windows® and other Microsoft products through online product support at the Microsoft Help and Support Web site:

  http://support.microsoft.com/

If you are unable to resolve your questions with the help available at these online sites, and the Express5800/320Ma system is covered by a service agreement, please contact NEC Technical Support (866-269-1239).

Notices

- All regulatory notices are provided in the site planning guide for your system.

- Although this guide documents modem functionality, modems are not available for all systems. Ask your sales representative about modem availability.

- ActiveService Network (ASN) is not currently available, but may be ordered in the future.

Chapter 1
Overview of PCI Adapters

Peripheral component interconnect (PCI) adapters, along with the Express5800/320Ma I/O subsystem, provide the I/O capability for Express5800/320Ma systems. The following sections present an overview of the PCI adapters for Express5800/320Ma systems:

- "PCI Adapters Available with Express5800/320Ma Systems" on page 1-1
- "System Configurations and PCI Slot Availability" on page 1-3
- "PCI Slot Numbering, Reservations, and Performance" on page 1-3
- "Paired PCI Slots and Duplex Operation of PCI Adapters" on page 1-4
- "General References" on page 1-5

PCI Adapters Available with Express5800/320Ma Systems

Table 1-1 lists the PCI adapters that NEC Solutions (America), Inc. supports for Express5800/320Ma systems, the vendor name and part numbers for each adapter, and the chapter that provides a detailed description for the adapter. The chapters present the following information about the PCI adapters:

- Hardware requirements, including PCI slot assignments and the number of PCI adapters of this type allowed in each system
- Software requirements, including information about checking the Web for the latest PCI adapter drivers, if applicable
- Cabling requirements, including the cables required for the PCI adapter and the part numbers for the cables, where applicable
- Configuration information, including information about configuring the PCI adapter and instructions for using configuration utilities, where applicable
- Troubleshooting information, including specific information about troubleshooting the PCI adapter

Table 1-1. Supported PCI Adapters

PCI Adapter	Vendor Adapter Name (Vendor Part Number)	Part Number	Reference
U463 Virtual Technician Module (VTM)	NEC Solutions (America), Inc. U463 Virtual Technician Module	AA-U46300	See **Notes**, this section.
U52500 or U52510 Optical Fibre Channel PCI Adapters (connects to a SAN or switch attached to an EMC® CLARiiON® or Symmetrix® RAID storage system)	QLogic® QLA2310F or QLA2310FL 2-Gbps Fibre Channel to PCI-X Host Bus Adapter, multimode optical (QLA2310F)	AA-U52500 AA-U52510	Chapter 3, "U525 and U526 Optical Fibre Channel PCI Adapters"
U52600 or U52610 Optical Fibre Channel PCI Adapters (attaches directly to an EMC CLARiiON or Symmetrix RAID storage system)	QLogic QLA2310F or QLA2310FL 2-Gbps Fibre Channel to PCI-X Host Bus Adapter, multimode optical, for direct connections to RAID storage system (QLA2310F)	AA-U52600 AA-U52610	Chapter 3, "U525 and U526 Optical Fibre Channel PCI Adapters"
U575 Dual-Port Copper Gigabit Ethernet Adapter	Intel PRO/1000 MT Dual Port Server Adapter (PWLA8492MFT)	AA-U57500	Chapter 2, "Ethernet PCI Adapters"

NOTES

1. For information about the U463 Virtual Technician Module, see the *Express5800/320Ma Virtual Technician Module User's Guide*, the *Express5800/320Ma ActiveService Network Configuration Guide*, and the operation and maintenance guide for your system (as listed in Table 1-2).

2. For information about the U531 Optical Fibre Channel PCI Adapter, see *Attaching an EMC CLARiiON AX100 Storage System to an Express5800/320Ma System*.

System Configurations and PCI Slot Availability

Express5800/320Ma systems contain two CPU‑I∕O enclosures, each of which contains a *CPU element* and an I/O *element*. The duplication of enclosures provides redundancy in components such as processors, hard drives, PCI slots, and certain I/O ports. PCI slots are logically associated with the I/O elements.

Express5800/320Ma 3.2 GHz systems contain one low-profile PCI slot in each enclosure, for a total of two PCI slots in the system. Optionally, you can install an AK533 attachment kit to add two full-height PCI slots to each enclosure Express5800/320Ma 3.2 GHz, for a total of six PCI slots in the system.

Express5800/320Ma 3.6 GHz and Dual-Core systems contain one low-profile PCI slot and two full-height PCI slots in each enclosure, for a total of six PCI slots in the system.

The CPU‑I∕O enclosures are removable and hot-pluggable. When you remove one CPU‑I∕O enclosure to install a PCI adapter, the other enclosure in the system continues to operate, providing uninterrupted use of the system.

You can use ftServer System Management Console (ftSMC) to view and manage the components, including PCI adapters, in each I/O element. However, note that all I/O elements display as **I/O enclosure - *n*** in ftSMC. Similarly, this manual and other ftServer manuals may use the term enclosure in place of the term element.

For more information about working with elements and enclosures, see the operation and maintenance guide for your system, as listed in Table 1-2. For more information about ftSMC, see the *Express5800/320Ma: System Administrator's Guide* and the online Help.

PCI Slot Numbering, Reservations, and Performance

Each CPU‑I∕O enclosure in Express5800/320Ma 3.6 GHz and Dual-Core systems contains one low-profile PCI slot that is physically labeled 1 and two additional full-height PCI slots that are physically labeled 2 and 3 (see Figure 1-1). ftSMC displays these slots as **PCI Slot Info - 9, 10,** and **11**.

Similarly, each CPU‑I∕O enclosure in Express5800/320Ma 3.2 GHz systems contains one low-profile PCI slot that is physically labeled 1. ftSMC displays this slot as **PCI Slot Info - 9**. In Express5800/320Ma 3.2 GHz systems, you can optionally install an AK533 attachment kit to add two full-height slots, providing the same configuration as Express5800/320Ma 3.6 GHz and Dual-Core systems.

Each slot in a Express5800/320Ma 3.2 GHz or 3.6 GHz system runs at a maximum of 100 megahertz (MHz). Slots 2 and 3, if present, are on one dedicated PCIX 100-MHz bus, with no other traffic. Slot 1 is on a 100-MHz bus, but shares this bus with the embedded Ethernet adapters and with a PCI bridge that carries the VGA, USB, SATA disk, CD-ROM, and VTM traffic.

No slots are reserved; however, you can install full-height PCI adapters only in slot 2 or slot 3.

See the Hardware Requirements section in each chapter for specific installation recommendations for each adapter.

> N O T E ————————————————————————
>
> You must insert PCI-slot filler panels in empty PCI slots to maintain proper airflow.

Figure 1-1. PCI Adapter Slot Numbering

asys030
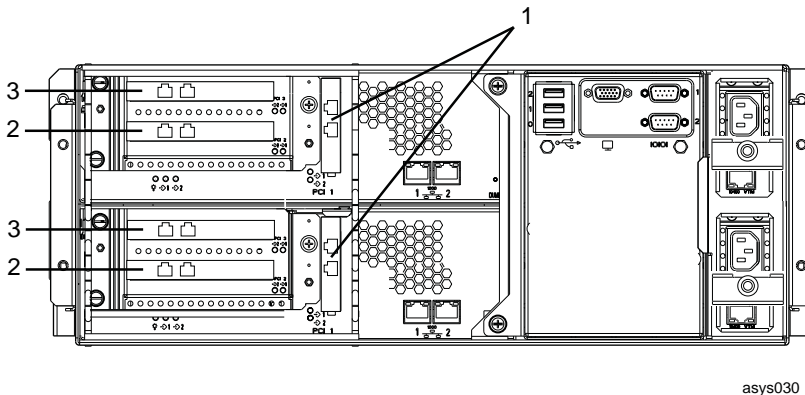
1	Slot 1 - **PCI Slot Info - 9** (low-profile slot)
2	Slot 2 - **PCI Slot Info - 10** (full-height slot, when present)
3	Slot 3 - **PCI Slot Info - 11** (full-height slot, when present)

Paired PCI Slots and Duplex Operation of PCI Adapters

Matched PCI adapters located in the same-numbered slot of two I/O elements are known as *paired* adapters. For example, if you install the same model of PCI adapter in PCI slots 10/1 and 11/1 (where 10 and 11 are the I/O element numbers and 1 is the slot number), the adapters are paired.

As long as each PCI adapter in a pair is configured properly and functioning normally, the pair of adapters is marked as *duplexed* in ftSMC, meaning that the adapters are fault tolerant and safe to pull. If you remove one PCI adapter in the pair, the other adapter keeps the system operational. Conversely, if one of the adapters in the pair is missing, or if one of the adapters fails, the remaining adapter is marked as *simplexed* in ftSMC, meaning that the adapter is not fault tolerant, and it is unsafe to pull.

N O T E ─────────────────────────────────

If you remove a simplexed PCI adapter, or if it fails, communications for applications related to that adapter will terminate. Removing one of two duplexed PCI adapters, however, will not affect communications. To increase the fault tolerance of a system, always install PCI adapters for critical applications in paired slots, and ensure that the adapters are marked as duplexed in ftSMC.

Duplex and simplex mode are also indicated on the PCI slot status LEDs that are located at the rear of each system. Furthermore, because PCI slot status can affect other subsystems, a missing or broken PCI adapter might change ftSMC properties and LED states for an I/O enclosure as well as an entire system.

For more information about using ftSMC to determine whether your PCI adapters or I/O enclosures are operating in duplex mode, see the *Express5800/320Ma: System Administrator's Guide*. For information about using status LEDs to determine the PCI slot status, see the operation and maintenance guide for your system, as listed in Table 1-2.

General References

Table 1-2 lists the location of information about PCI adapters in other Express5800/320Ma documents.

Table 1-2. General Reference Information for PCI Adapters

Topic	Reference Document(s)
Hardware installation instructions	*Express5800/320Ma: Installation Guide*
Overall view of system administration and using ftSMC	*Express5800/320Ma: System Administrator's Guide*
Device IDs	
Using VTM console to check system software and network connections to the VTM adapter, and to verify if the firmware for the adapter is up to date.	*Express5800/320Ma Virtual Technician Module User's Guide*

Table 1-2. General Reference Information for PCI Adapters *(Continued)*

Topic	Reference Document(s)
Status LEDs for I/O enclosures and PCI slots	*Express5800/320Ma: Operation and Maintenance Guide*
General troubleshooting procedures	
General maintenance information	
CRU replacement procedures	

Chapter 2
Ethernet PCI Adapters

The following sections describe the supported Ethernet PCI adapters:

- "U575 Dual-Port Copper Gigabit Ethernet Adapters" on page 2-1
- "Embedded Ethernet PCI Adapters" on page 2-2

> N O T E —————————————————
>
> Your system may also contain dedicated Ethernet ports
> for U463 Virtual Technician Modules, but these Ethernet
> ports are intended for a local maintenance network. For
> more information, see the *Express5800/320Ma Virtual
> Technician Module User's Guide*.

The following sections provide detailed information about Ethernet PCI adapters:

- "Hardware Requirements of Ethernet PCI Adapters" on page 2-3
- "Software Requirements of Ethernet PCI Adapters" on page 2-4
- "Cabling Requirements of Ethernet PCI Adapters" on page 2-5
- "Configuring Ethernet PCI Adapters" on page 2-6
- "Troubleshooting Ethernet PCI Adapters" on page 2-35

U575 Dual-Port Copper Gigabit Ethernet Adapters

The U575 Dual-Port Copper Gigabit Ethernet Adapter is a low dual-port PCI adapter
based on the Intel 82546 gigabit controller. The U575 PCI adapter supports
1000Base-T, 100Base-TX, and 10Base-T Ethernet network topologies with a PCI
data-path width of 64 bits.

If you order a U575 PCI adapter separately from the system, the adapter is outfitted
with a low-profile faceplate. A high-profile faceplate is a part of the kit. See Appendix A,
"Converting Adapters for Low- and High-Profile PCI Slots" for information about
converting the adapter for use in a high-profile slot.

For a summary of its general features and requirements, see Table 2-6. For an
illustration of its faceplate, see Figure 2-1.

Table 2-6. U575 PCI Adapter Features and Requirements Summary

Feature/Requirement	Description
PCI Adapter Type	Dual-port copper, 10/100/1000-Mbps Ethernet PCI adapter
Part No.	AA-U57500
Supported systems	Express5800/320Ma 3.2 GHz, 3.6 GHz, and Dual-Core
Required/Optional	Optional
Slot Assignment	Any slot; slot 2 or 3 in Express5800/320Ma 3.2 GHz, 3.6 GHz, and Dual-Core systems for best performance
Cable Requirements	Two UTP Ethernet cables with RJ-45 connectors, minimum Category 5 (customer-supplied)

Figure 2-1. Faceplate of the U575 PCI Adapter

spci004a
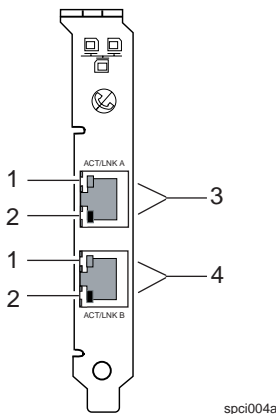
1	Activity/Link LED
2	10/100/1000-Mbps LED
3	Port A (port 0 in ftSMC)
4	Port B (port 1 in ftSMC)

Embedded Ethernet PCI Adapters

Your system contains two embedded 10/100/1000-Mbps Ethernet PCI adapters in each CPU-I∕O enclosure. For diagrams of the ports for these adapters, see Figure 2-23.

Requirements and configuration procedures for the embedded Ethernet PCI adapters are similar to the procedures for the other Ethernet PCI adapters.

Hardware Requirements of Ethernet PCI Adapters

For fault tolerance, install Ethernet PCI adapters that are in the same team in different I/O elements. Although teamed Ethernet PCI adapters in the same I/O element are marked as duplexed in ftSMC, they are not fault tolerant. If the I/O element fails, or if you remove the physical enclosure that contains the adapters (in a system with more than one enclosure), network connectivity is lost.

Table 2-7 describes the slot-location requirements and recommendations for the U574 PCI adapter and the U575 PCI adapter. If you plan to configure Ethernet PCI adapters into teams, also consider the configuration requirements described in "Configuring Ethernet Teams" on page 2-14.

Table 2-7. U575 PCI Adapter Slot Locations

System	Slot-Location Requirements and Recommendations
Express5800/320Ma 3.2 GHz, 3.6 GHz, and Dual-Core	For maximum throughput, install U574 PCI adapters and U575 PCI adapters in a two-way symmetric multiprocessing (SMP) system. The data load between teamed gigabit Ethernet PCI adapters is balanced only in systems with two CPUs in each CPU enclosure. For best performance, install multi-port Ethernet PCI adapters in slot 2 or slot 3. (To add slots 2 and 3 in an Express5800/320Ma 3.2 GHz system, install the AK533 attachment kit. See the *Express5800/320Ma: Operation and Maintenance Guide* for more information.)

Table 2-8 lists the maximum number of Ethernet PCI ports that Express5800/320Ma systems support.

Table 2-8. Maximum Number of Ethernet PCI Adapters

System	U575 PCI Adapter	Maximum Number of Ports[†]
Express5800/320Ma 3.2 GHz[‡]	2	8 (4[†] ports, 2 on each unembedded adapter and 4 on embedded Ethernet adapters)
Express5800/320Ma 3.6 GHz and Dual-Core	6	16 (6[†] ports, 2 on each unembedded adapter and 4 on embedded Ethernet adapters)

† Each dual-port Ethernet PCI adapter appears as two adapters in PROSet, Device Manager, and My Network Places.

‡ If you install the AK533 attachment kit in an Express5800/320Ma 3.2 GHz system, the maximum number of Ethernet PCI adapters will be the same as in an Express5800/320Ma 3.6 GHz system.

Software Requirements of Ethernet PCI Adapters

Ethernet PCI adapters require the following software:

- sragbe.sys Ethernet driver

  The Express5800/320Ma System Software initial program load (IPL) installs this driver for all 10/100/1000-Mbps Ethernet adapters supplied by NEC Solutions (America), Inc. PnP (Plug and Play) Manager recognizes the driver and loads it automatically.

  This Ethernet driver has an added*surprise removal* feature to increase fault tolerance. The surprise removal feature prevents system crashes in the event that a PCI adapter is removed without software notification to the system.

  > N O T E S
  >
  > 1. Using any other driver will **invalidate** the Express5800/320Ma 100% Availability Terms and Conditions. For information about the Express5800/320Ma 100% Availability Terms and Conditions, contact your representative.
  >
  > 2. To upgrade a driver, contact NEC Technical Support or your authorized Service Representative.

- Intel(R) PROSet for Wired Connections utility, Version 9.0

  The Express5800/320Ma System Software IPL installs this utility automatically. Use PROSet to configure and troubleshoot Ethernet PCI adapters.

  > N O T E
  >
  > Do not attempt to upgrade PROSet to a newer version of this software available directly from Intel. If you install a version of PROSet that is not qualified and released by NEC Solutions (America), Inc., its installation procedure will change the Express5800/320Ma default properties for Ethernet PCI adapters.

Cabling Requirements of Ethernet PCI Adapters

The following sections describe the cabling requirements of the following Ethernet PCI adapters:

- "Cabling U575 and Embedded Ethernet PCI Adapters" on page 2-5

> N O T E ————————————————————————————
>
> Label each cable that you attach to a PCI adapter, noting the host name, I/O element number, PCI slot number, and port number (if applicable) to which the cable connector attaches.

Cabling U575 and Embedded Ethernet PCI Adapters

The U575 PCI adapter and embedded Ethernet PCI adapters require customer-supplied, Unshielded Twisted Pair (UTP) Ethernet cables with RJ-45 connectors (see Figure 2-2). For each port, supply a 24 AWG, 4-pair, UTP EIA/TIA-Verified, Category-3 or Category-5 wire cable, with RJ-45 modular connectors terminated with pair-wiring adhering to the EIA/TIA 568-A or EIA/TIA 568-B standard.

The speed of the network determines the grade of UTP cable that you can use:

- 10 Mbps requires UTP Category-3 or Category-5 Data-Grade cable.
- 100 Mbps and 1000 Mbps require UTP Category-5 Data-Grade cable. Use of Category-3 Data-Grade cable for 100 Mbps or 1000 Mbps would cause data loss. For 1000 Mbps, use Category-5e Data-Grade cable.

To connect to an Ethernet hub or switch, use a straight-through cable, not a crossed-pair (1-3, 2-6) cable or an Ethernet crossover cable. The maximum distance between the PCI adapter and an Ethernet hub or a switch is 328 ft (100m).

Figure 2-2. RJ-45 Connector

mpci009

mpci083
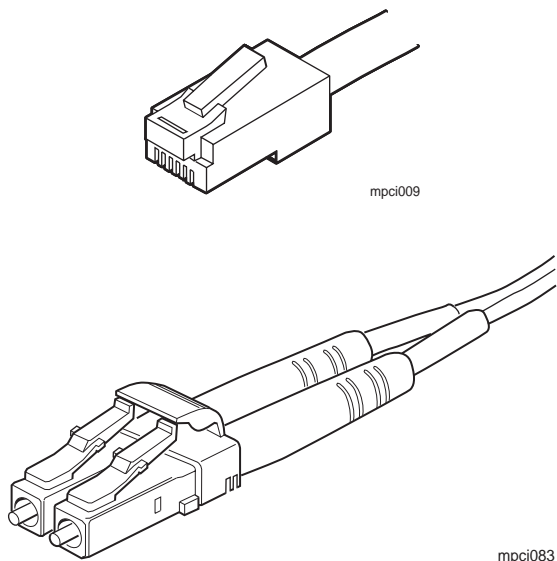
Configuring Ethernet PCI Adapters

Use the PROSet utility to configure Ethernet PCI adapters (see "Starting PROSet" on page 2-7). PROSet is part of the Ethernet PCI adapter software.

Use PROSet to perform the following tasks:

- Locate a PCI adapter (see "Locating Ethernet PCI Adapters" on page 2-15) in a system with many Ethernet PCI adapters.

- Configure the line speed and/or duplex mode of an Ethernet PCI adapter with values appropriate to the adapter and the media to which it connects (see "Configuring Link Speed and Duplex Mode" on page 2-16).

- Configure Ethernet PCI adapters into teams (see "Types of Fault-Tolerant Ethernet Teams" on page 2-9). For information about how to configure the teams, see "Configuring Ethernet Teams" on page 2-14.

- Assign virtual LANs to a team (see "Virtual LANs" on page 2-13). For information about how to configure the VLANs, see "Configuring Virtual LANs Over a Team" on page 2-22.

- Manage a team by removing or adding adapters, or removing the team (see "Managing Ethernet Teams" on page 2-27).

- Modify the advanced settings of an individual Ethernet PCI adapter, a team, or a VLAN (see the PROSet online help).

- Troubleshoot Ethernet PCI adapters (see "Using PROSet Utility Diagnostics" on page 2-41).

> N O T E S
>
> 1. In systems with more than one enclosure, you can physically remove an enclosure without disrupting the network **only if the active Ethernet PCI adapters in the enclosure are teamed with adapters in another enclosure**. Note that with Adaptive Load Balancing and Link Aggregation teams, your system will experience a drop in throughput while the enclosure is absent.
>
> 2. For fault tolerance, configure your Ethernet PCI adapters into teams. Although Express5800/320Ma systems support unteamed Ethernet PCI adapters, an unteamed Ethernet PCI adapter is a single point of failure that can cause the loss of a network connection.
>
> 3. After you finish each configuration procedure using PROSet, click **Apply** or **OK** in the **Intel(R) PROSet for Wired Connections** dialog box (see Figure 2-3 for an example of the dialog box) to preserve your changes. If you do not click **Apply** or **OK** before exiting PROSet, it cannot finish processing the configuration procedure, and you must repeat the procedure.

Starting PROSet

To start the PROSet utility, use one of the following methods:

> N O T E
>
> Before starting PROSet, close the **Local Area Connection *n* Properties** dialog boxes (Figure 2-13) for all Ethernet PCI adapters; any open **Properties** dialog box can cause problems for viewing and setting values in PROSet.

- Double-click **PROSet** in the system tray:

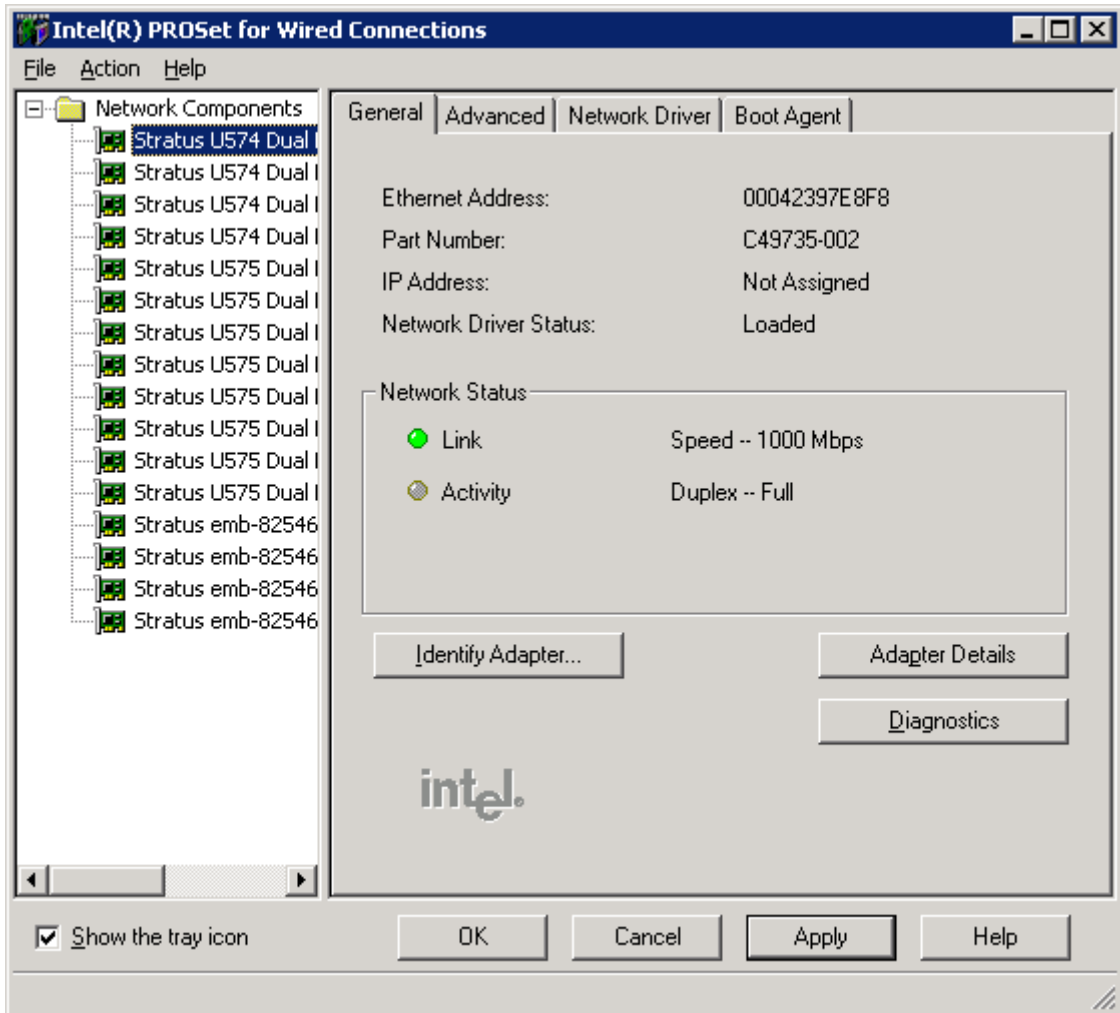- Double-click **PROSet** in the **Control Panel**:

A PROSet dialog box appears (see Figure 2-3 for an example).

Figure 2-3. Initial PROSet Dialog Box

If you need to start PROSet remotely, you can use Windows Remote Desktop to access PROSet (and the system's desktop). You can then create or modify a team if it is not carrying your connection to the system.

N O T E S

1. When you are using PROSet remotely through Remote Desktop, do not modify the team that provides your connection to the system. Doing so will result in a loss of network connection.

2. Only one user can access PROSet at a time. If you attempt to start PROSet and nothing happens, another user might be running PROSet in a Remote Desktop session. Use Task Manager to check for the **PROSet.exe** process.

For more information about the PROSet utility, read the PROSet online help, which you access by clicking **Help** from the PROSet main window.

Types of Fault-Tolerant Ethernet Teams

You can configure Ethernet PCI adapters into teams to increase fault tolerance or performance, or both.

In a team, one Ethernet PCI adapter is the primary adapter (or active adapter), and all other Ethernet PCI adapters are secondary adapters (or backup adapters). In some cases, the primary adapter is the only active adapter of the team; the secondary adapter becomes active only if the primary adapter fails. In other cases, all members of the team actively pass traffic to increase overall transmit or receive throughput.

When you create a team, PROSet automatically assigns the primary and secondary adapters; however, if necessary, you may manually designate one primary and one secondary adapter per team. For example, if you are creating a team with mixed Ethernet PCI adapters, you might want to designate the fastest adapter as the primary adapter.

Typically, the permanent Media Access Control (MAC) address of the primary Ethernet PCI adapter becomes the current MAC address for all Ethernet PCI adapters in one team. (The MAC address is the PROSet **Ethernet Address**.)

Express5800/320Ma systems support the following types of Ethernet fault-tolerant teams:

- "Adapter Fault Tolerant Teams"
- "Switch Fault Tolerant Teams"
- "Adaptive Load Balancing Teams"
- "Static Link Aggregation Teams"
- "IEEE 802.3ad Dynamic Link Aggregation Teams"

You can assign any Ethernet PCI adapter supplied by NEC Solutions (America), Inc. to any type of team, with some exceptions for static link aggregation teams. See "Static Link Aggregation Teams" on page 2-11 for details.

N O T E ———————————————————————

Also see the PROSet online help for additional teaming information and restrictions.

Adapter Fault Tolerant Teams

An Adapter Fault Tolerant (AFT) team is a set of two or more Ethernet PCI adapters that provide redundant connections to a single switch. In an AFT team, the primary adapter executes all transmit and receive functions for the team. The secondary adapter becomes active after a failover to the secondary adapter occurs, generally when the primary adapter fails.

Switch Fault Tolerant Teams

A Switch Fault Tolerant (SFT) team is similar to an AFT team, except that SFT allows you to connect the team members to separate switches for increased fault resiliency. An SFT team must contain exactly two Ethernet PCI adapters, and you must connect each adapter to a different switch that supports the Spanning Tree Algorithm. As in an AFT team, the primary adapter executes all transmit and receive functions for the team. The secondary adapter becomes active after a failover to the secondary adapter occurs, generally when the primary adapter fails or its link to the switch fails.

Adaptive Load Balancing Teams

In an Adaptive Load Balancing (ALB) team, both the primary and secondary Ethernet PCI adapters execute the transmit function, while only the primary adapter executes the receive function. (ALB functionality also includes AFT features.)

To prevent packet-order problems, one adapter in an ALB team transmits all packets that have the same destination. In addition, only the primary adapter transmits broadcast packets and non-Internet Protocol (IP) packets.

You must connect all adapters in an ALB team to the same switch, or to two or more hubs that connect to the same switch.

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When you create a new ALB team, PROSet automatically sets the **Receive Load Balancing** property for the team to **On** to balance received traffic over all members of the team. However, enabling this feature for ALB teams can cause connectivity problems. If the primary adapter in the team fails when this feature is enabled, the Ethernet address of the team automatically changes to the MAC

address of the new primary adapter. As a result, some packets are dropped until the new primary adapter can reestablish connections using the new Ethernet address (possibly a 30-second or more delay). To disable receive load balancing and to improve fault tolerance, you must manually set the value of the **Receive Load Balancing** property to **Off** in the **Advanced** tab for the ALB team. (The ALB team continues to balance traffic that the team **transmits**.)

Static Link Aggregation Teams

Static link aggregation increases transmission and reception throughput by balancing both transmit and receive traffic over all members of the team. (Static link aggregation also includes AFT features.)

You must connect all members of a static aggregation team to a single switch that supports either the Fast EtherChannel (FEC) standard or the Gigabit EtherChannel (GEC) standard, and the relevant switch ports must be properly configured for it. When you create a static link aggregation team, it automatically negotiates a FEC or GEC connection, depending on the type and configuration of the switch.

Table 2-9 lists the types of static link aggregation teams that each Ethernet PCI adapter supports. See your switch documentation to determine which types of teams it supports.

Table 2-9. Supported Ethernet Fault-Tolerant Teams

Ethernet PCI Adapter	FEC	GEC
Embedded 10/100/1000-Mbps	Yes (when configured at 10- or 100-Mbps)	Yes (when configured at 1000-Mbps)
U575	Yes (when configured at 10- or 100-Mbps)	Yes (when configured at 1000-Mbps)

IEEE 802.3ad Dynamic Link Aggregation Teams

IEEE 802.3ad Dynamic Link Aggregation teams provide full transmit and receive load balancing like the FEC and GEC standards, but in a dynamic-mode implementation. Dynamic mode is an implementation of the **final** 802.3ad specification.

Many switches support an implementation of only the draft 802.3ad specification, which does not include dynamic mode. To determine whether your switch is fully compatible with the dynamic-mode implementation of the 802.3ad standard, contact your switch vendor.

Note that the Ethernet PCI adapters in an 802.3ad team cannot be connected to a hub. The adapters must be connected to a single switch that supports the final 802.3ad specification, and the relevant switch ports must be properly configured for it. (802.3ad teams also include AFT features.)

> N O T E ————————————————————
>
> To maximize performance with dynamic link teams, use fewer teams, but more Ethernet PCI adapters in each team.

Fault-Tolerant Ethernet Teams and IP Multicasting

If IP multicasting is in use on your network, consider the following restriction when choosing the type of fault-tolerant team to configure.

Each network host in an IP multicast group uses the Internet Group Management Protocol (IGMP) to acknowledge and maintain its IP multicast group membership with a switch.

In an AFT, SFT, or ALB team, only one Ethernet PCI adapter (the primary adapter) is registered to receive IP multicast packets. When failover to another adapter occurs, the host cannot automatically update its multicast group membership using the new primary adapter; therefore, the host stops receiving multicast packets. If the switch is configured to periodically query the host for its registration, or if static IGMP is configured on the switch for each adapter in the team, multicasting to the host will eventually resume, but possibly after an extended interruption.

If you use IP multicasting, and you want to configure an AFT, SFT, or ALB team, you should test the team on site to verify if the behavior of IP multicasting after failover is acceptable. Alternatively, you can configure either static or dynamic link aggregation teams. IP multicasting functions more reliably with qualified switches that support these modes, because all Ethernet PCI adapters in a link aggregation team are registered to receive the IP multicast packets. The team continues to receive IP multicast packets unless all links to the switch are lost and then restored (in which case, there is also an extended interruption).

For more information about IP multicasting, see the documentation for your switch, or contact your network administrator.

Virtual LANs

You can add a Virtual LAN (VLAN) to any type of Ethernet team.

> N O T E ————————————————————————
>
> NEC Solutions (America), Inc. supports VLANs only over
> Ethernet teams, not over individual adapters. An
> unteamed adapter is a single point of failure that can
> cause the loss of a network connection.

A VLAN allows you to isolate network traffic for a specific group of network hosts. Using VLANs, you can organize networked systems into logical workgroups, such as Marketing or Engineering, that span a building, complex, or an entire enterprise network. Members of a particular VLAN receive traffic only from other members of the same VLAN.

VLANs are particularly useful for limiting broadcast storms, reducing security problems, and simplifying network management.

There are two types of VLANs:

- Implicit VLANs, which are configured entirely at the switch level. The switch does not alter or tag packets to enforce an implicit VLAN.

- Explicit VLANs, which are configured throughout the network, on each adapter and link partner. Switches identify and route traffic based on a four-byte tag (802.3ac) in each packet header.

To support either type of VLAN, switches on your network must support 802.1Q VLANs. Also, to configure a VLAN on your system, you need to contact your network administrator to obtain the VLAN ID for your workgroup, which must be identical to the VLAN ID programmed into the switches.

In an environment with many VLAN workgroups, you can optionally implement the GARP VLAN Registration Protocol (GVRP) to dynamically create, change, and remove VLANs. To support GVRP, all adapters and switches on your network must have GVRP enabled. For information about configuring and using GVRP, see the PROSet online help and the documentation for your switch, or contact your network administrator.

Configuring Ethernet Teams

Use the PROSet utility to configure Ethernet PCI adapters into teams. Keep the following notes, guidelines, and restrictions in mind when you create a team:

- If you disable a team but subsequently make and apply any changes in the PROSet utility, PROSet enables the team again. Clicking Apply in the PROSet utility enables all teams. To disable the teams again, use Device Manager or My Network Places.

- Each port on a dual-port Ethernet PCI adapter appears as a separate adapter in PROSet.

- Generally, assign Ethernet PCI adapters of only one media type (fiber optic or copper) to a team. For instance, you should assign only U574 PCI adapter ports (fiber optic) to a team, or only U575 PCI adapter ports (copper). You could also assign embedded 10/100/1000-Mbps Ethernet PCI adapter ports (copper) and U575 PCI adapter ports (copper) to a team.

- Manually configure values for the data rate and duplex mode of Ethernet PCI adapters that operate at 10 or 100 Mbps (see "Configuring Link Speed and Duplex Mode" on page 2-16). Although these values are set automatically by default, automatic settings can result in unreliable connections and inaccurate reporting of link activity and duplex mode. Always use the same data rate and duplex mode values for all members of a team.

- PROSet supports 2-8 Ethernet PCI adapters (ports) in a team. For teaming purposes, some switches might require you to populate sets of two- or four-switch ports at a time. Determine the requirements of the switch that you are using, and add the appropriate number of adapters to the team.

- There is no minimum or maximum number of teams in PROSet; teams are limited only by the number of adapters available in your system and how you allocate them.

- For fault tolerance, create teams that contain Ethernet PCI adapters from different I/O elements. Only teams with Ethernet PCI adapters in different I/O elements are fault tolerant. (See "Locating Ethernet PCI Adapters" on page 2-15 for information about using PROSet to locate Ethernet PCI adapters.)

- NEC Solutions (America), Inc. does not support the creation of Express Teams. PROSet Express Teams provide a quick way of teaming all ports of a multiport Ethernet PCI adapter. Because the ports are in the same adapter and I/O element, an Express Team is a single point of failure.

- NEC Solutions (America), Inc.does not support the teaming of third-party Ethernet PCI adapters with Express5800/320Ma Ethernet PCI adapters. Only Express5800/320Ma Ethernet PCI adapters have been tested for compatibility and fault tolerance in Express5800/320Ma systems.

To configure Ethernet PCI adapters into fault-tolerant teams, perform the procedures described in the following sections, in the order listed.

Locating Ethernet PCI Adapters

When you create a team of Ethernet PCI adapters, you need to include adapters from different I/O elements for increased fault tolerance.

To verify that you are selecting the appropriate adapters, you can use the Identify Adapter feature of PROSet, which flashes a status LED in a specific Ethernet port on demand so you can visually identify it. This feature is compatible with all Express5800/320Ma Ethernet PCI adapters, including embedded Ethernet PCI adapters.
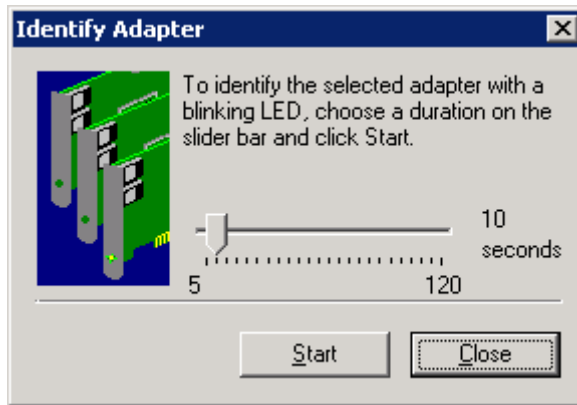
N O T E

To determine which LED on the Ethernet port will flash, see "Checking Status LEDs" on page 2-36.

To locate an Ethernet PCI adapter port

1. Start the PROSet utility if you have not already done so (see "Starting PROSet" on page 2-7).

2. In the **Intel(R) PROSet for Wired Connections** dialog box, right-click a teamed or unteamed Ethernet PCI adapter (port), and click the **General** tab (Figure 2-3).

3. In the **General** tab, click **Identify Adapter**.

4. In the **Identify Adapter** dialog box (Figure 2-4), specify the amount of time (in seconds) you want the LED on the Ethernet PCI adapter port to flash. (Consider the time it will take you to reach the rear of the system to see the LED flash.)

Figure 2-4. Identify Adapter Dialog Box

5. Click **Start** to flash the LED.

   The LED flashes for the specified number of seconds. Find the Ethernet port with the flashing LED and make note of its device name in PROSet.

6. When the flashing stops, you can click **Start** to flash the LED again or **Close** to dismiss the **Identify Adapter** dialog box. If necessary, repeat steps 2-6 to locate additional adapters.

Configuring Link Speed and Duplex Mode

By default, Ethernet ports onU575 Ethernet PCI adapters and embedded Ethernet PCI adapters are configured to autonegotiate the best speed for a connection. On a network that operates at 10 or 100 megabits per second (Mbps), automatic settings can result in unreliable connections and inaccurate reporting of link activity and duplex mode. For reliable operation, manually configure the link speed and duplex mode for all Ethernet PCI adapters connected to networks that operate at 10 or 100 Mbps.

> N O T E S ─────────────────────────────
>
> 1. For Ethernet adapters or ports connected to networks running at 1 gigabit per second (Gbps), rely on autonegotiation. Do not manually configure 1-Gbps operation.
>
> 2. Express5800/320Ma systems support 1-Gbps line speed only in full-duplex mode.

When you manually set these values, make sure that the values are identical for the Ethernet port and the link partner to which it connects, and that the settings for all Ethernet ports in one team are the same.

To set the link speed and duplex mode
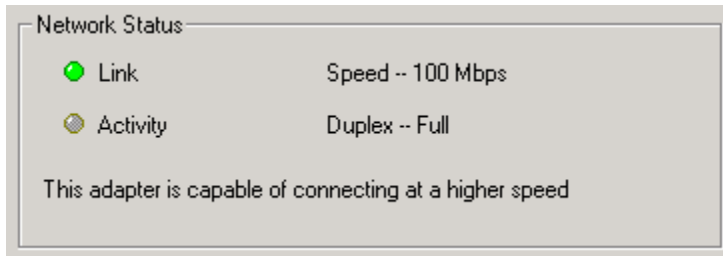
1. Start the PROSet utility if you have not already done so (see "Starting PROSet" on page 2-7).

2. In the left pane of the **Intel(R) PROSet for Wired Connections** dialog box, click an adapter. (Each port on a dual-port Ethernet PCI adapter appears as a separate PCI adapter in PROSet.) If necessary, expand a team to access its member adapters.

3. Click the **Speed** tab.

4. Under **Link Speed and Duplex Settings**, select the speed and duplex mode appropriate to the port and to the type of line to which the port is connected. Figure 2-5 shows how to specify 100 Mbps and full duplex for one of the ports on a U575 Dual-Port Copper Gigabit Ethernet Adapter.

Figure 2-5. Setting the Link Speed and Duplex Mode
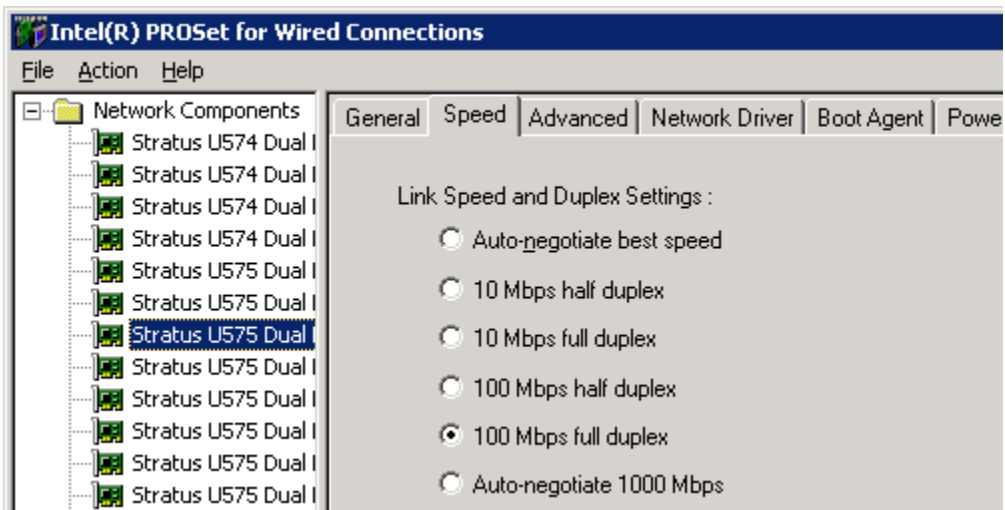
5. Repeat steps 2 through 4 for each Ethernet PCI adapter for which you need to set the link speed and duplex mode.

6. Click **Apply** to process and preserve the changes. Allow several seconds for PROSet processing time.

7. In the **General** tab for each adapter you updated, verify that the link speed and duplex settings are correct and, if a network cable is attached, that a link is established (Figure 2-6).

Figure 2-6. Verifying Link Speed, Duplex Mode, and Link Activity

If necessary, also verify the actual link speed and duplex mode LEDs on the Ethernet PCI adapters and the remote ports to which they are connected. If the link speed and duplex mode are incorrect, try removing and replacing the network cables. If the link speed and duplex mode are still incorrect, verify that your network equipment supports the link speed and duplex mode that you set.

8. Click **OK** to exit PROSet.

Creating Ethernet Teams

> ⚠ **C A U T I O N**
>
> Creating an Ethernet team disrupts the network traffic over all Ethernet PCI adapters in the team.

1. Start the PROSet utility if you have not already done so (see "Starting PROSet" on page 2-7).

2. In the **Intel(R) PROSet for Wired Connections** dialog box, right-click one of the Ethernet PCI adapters listed, point to **Add to Team**, and then click **Create New Team**.

   The **Teaming Wizard** starts.

3. In the first dialog box of the **Teaming Wizard** (Figure 2-7), select the type of team you want to create (for example, **Adapter Fault Tolerance**), and then click **Next**.

   Depending on the teaming mode you select, PROSet might display another dialog box with information about the restrictions for that mode. Click **Next** to continue.

Figure 2-7. Selecting the Type of Team
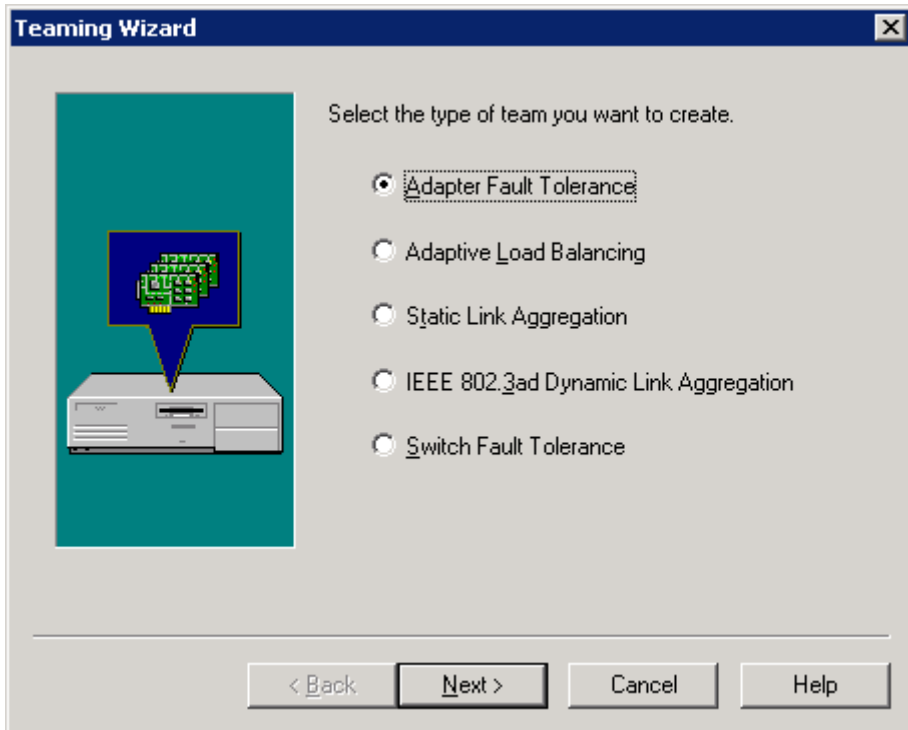
4. In the next dialog box of the **Teaming Wizard**, select the Ethernet PCI adapters for the team by clicking the check boxes next to each adapter. As you select adapters for a team, follow the cautions and notes listed at the beginning of this section ("Configuring Ethernet Teams" on page 2-14).

    Figure 2-8 shows an example of selecting four U575 PCI adapters for a team.

Figure 2-8. Selecting Ethernet PCI Adapters for a Team
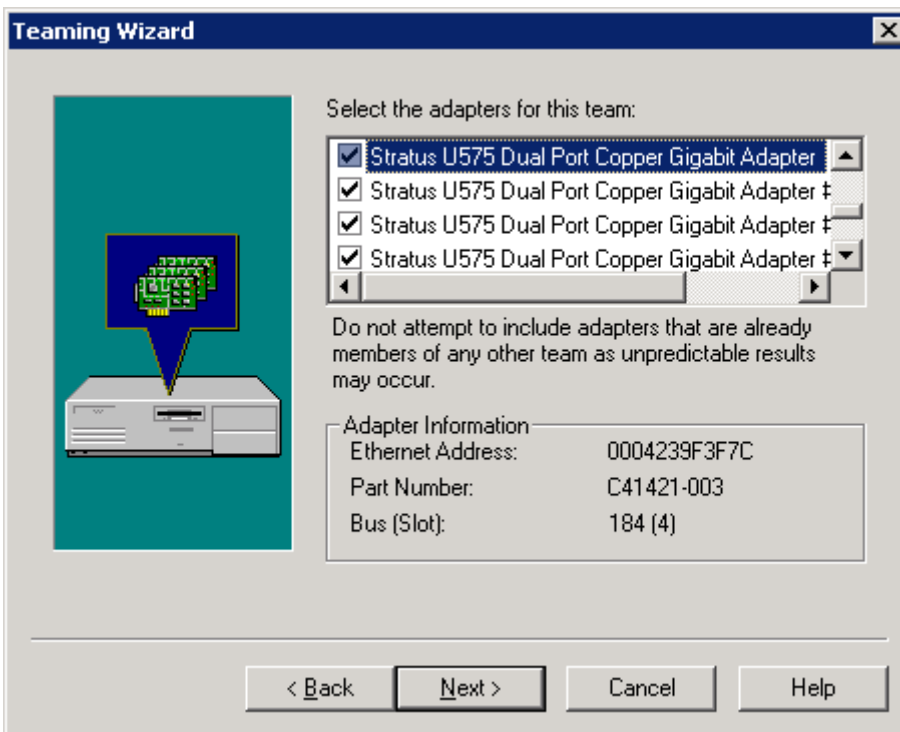
5. After you have selected the Ethernet PCI adapters for the team, click **Next**, and then click **Finish**.

6. When the **Intel(R) PROSet for Wired Connections** dialog box reappears, click **Apply**. (Do not designate primary or secondary adapters at this time.) PROSet begins to bind the specified PCI adapters into teams. This operation takes at least one minute per team to complete. **Do not abort** the operation until it has completed; otherwise, you must repeat the procedure.

7. After creating the teams, if necessary, you can manually designate a primary and secondary adapter for each team.

   a. In the left pane of the **Intel(R) PROSet for Wired Connections** dialog box, expand the team and **Member Adapters**.
   b. Right-click the Ethernet PCI adapter you want as the primary adapter, and select **Preferred Primary** from the menu. Figure 2-9 shows an example of specifying the primary adapter in a team of U575 PCI adapters.
   c. Right-click the Ethernet PCI adapter you want as the secondary adapter, and select **Preferred Secondary** from the menu.

Figure 2-9. Assigning Priorities to Ethernet PCI Adapters
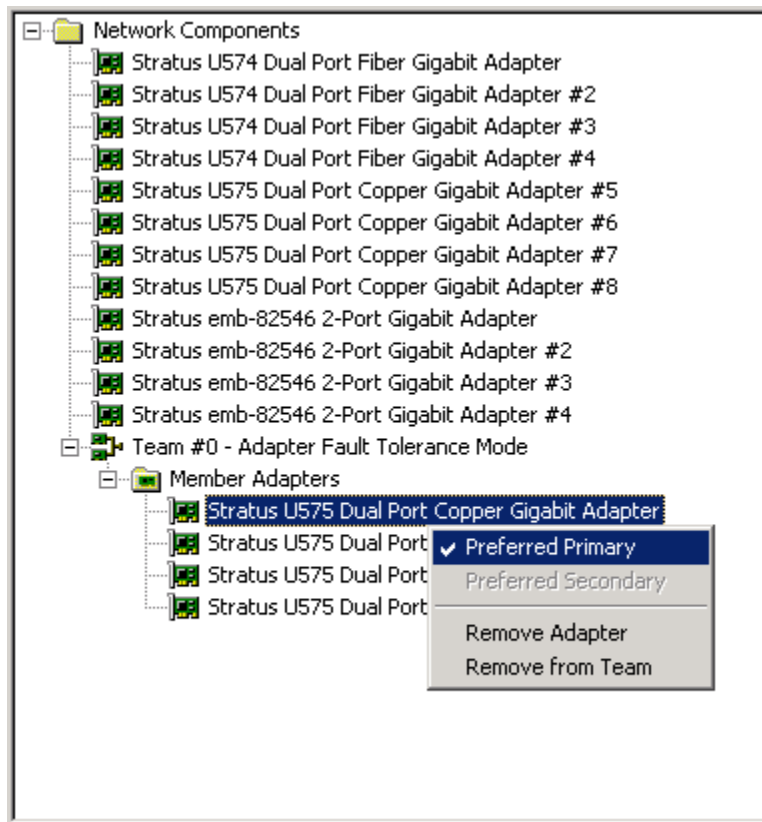
NOTE ──────────────────────────────

You can select only one primary adapter and only one
secondary adapter for a team. If you select another
primary or secondary adapter, it overrides your initial
selection. To confirm your selections, right-click the
adapters again. A check mark beside **Preferred Primary**
indicates that the Ethernet PCI adapter is the primary
adapter, and a check mark beside **Preferred Secondary**
indicates that the adapter is the secondary adapter.

8. Click **Apply** to process the changes. Allow time for PROSet to complete the
    procedure.

Configuring Virtual LANs Over a Team

⚠️ **C A U T I O N**

Configuring a VLAN over an Ethernet team disrupts the network traffic over the team.

N O T E

Configuring VLANs is optional. You can have an Ethernet team without VLANs.

1. Start the PROSet utility if you have not already done so (see "Starting PROSet" on page 2-7).

2. In the left pane of the **Intel(R) PROSet for Wired Connections** dialog box, right-click the appropriate team. In the menu that appears, click **Add VLAN** (see Figure 2-11).

Figure 2-10. Adding a VLAN to a Team
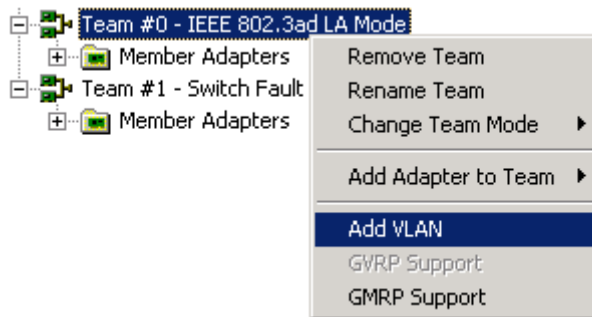
3. In the **Add New VLAN** dialog box (Figure 2-11), enter the VLAN **ID**. The VLAN ID must match the VLAN ID configured on the switch.

Figure 2-11. Specifying a VLAN ID and Name
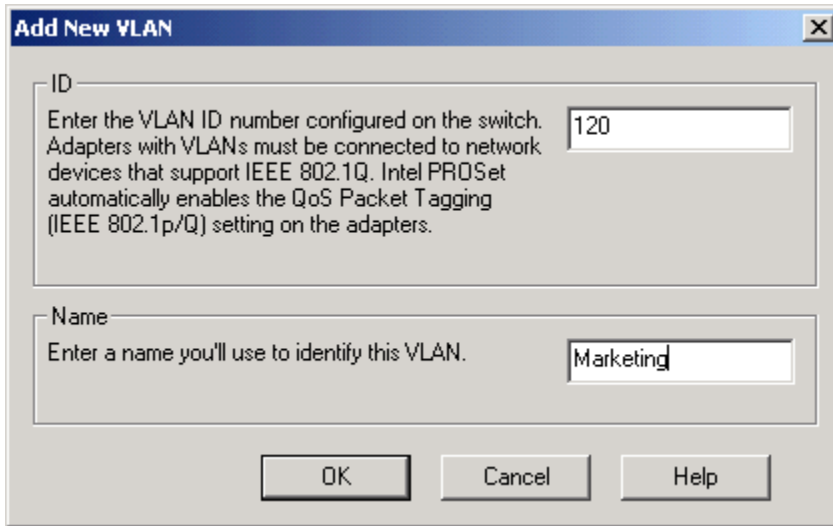
4. In the same dialog box, enter a **Name** for the VLAN. The name is only for identification, and it does not need to match the name of VLAN on other network devices.

5. Click **OK**. The new entry for the VLAN appears in **Virtual LANs**, under the team entry in the left pane of the **Intel(R) PROSet for Wired Connections** dialog box.

    To add additional VLANs, repeat step 2-5. (You can create up to 64 VLANs on a system.)

6. Click **Apply** in the **Intel(R) PROSet for Wired Connections** dialog box to process and save the changes.

Verifying the Configuration of Teams and VLANs

1. Close and restart the PROSet utility (see "Starting PROSet" on page 2-7). In PROSet, ensure that:

    -   The teams and VLANs have been created as you expected.

    -   All Ethernet PCI adapters in a team use the same Ethernet address, and that address is the permanent Ethernet address of one of the Ethernet PCI adapters in the team. (For ALB teams with receive load balancing enabled, each Ethernet PCI adapter uses its own permanent Ethernet address.) See "Updating a Team's Ethernet Address" on page 2-32 for more information.

2. Verify that an IP address has been assigned to each team or VLAN.

   - If you have created a team without VLANs, the team requires an IP address. (The individual Ethernet PCI adapters in a team have no IP addresses.)

     To find the IP address for a team in PROSet, click the entry for the team and see the **IP Address** in the **Team Configuration** tab.

   - If you have created a team with VLANs, each VLAN in that team requires an IP address. (The team and the Ethernet PCI adapters in the team have no IP addresses.)

     To find the IP address for a VLAN in PROSet, click the entry for the VLAN and see the **IP Address** in the **VLAN Configuration** tab.

   If a team or VLAN does not have an IP address, assign it one. See "Assigning an IP Address to a Team or VLAN" on page 2-24.

3. Start ftSMC, select each **Network Port** you teamed, and in the details pane, verify that the value next to **OpState: State** is **Duplexed**.

Assigning an IP Address to a Team or VLAN

1. Click **Start**, point to **Control Panel**, and double-click **Network Connections**.

2. In the **Network Connections** control panel (see Figure 2-12 for an example), right-click the appropriate **Team #*n*** or **VLAN *Name*, ID: *n*** icon, and then click **Properties**.

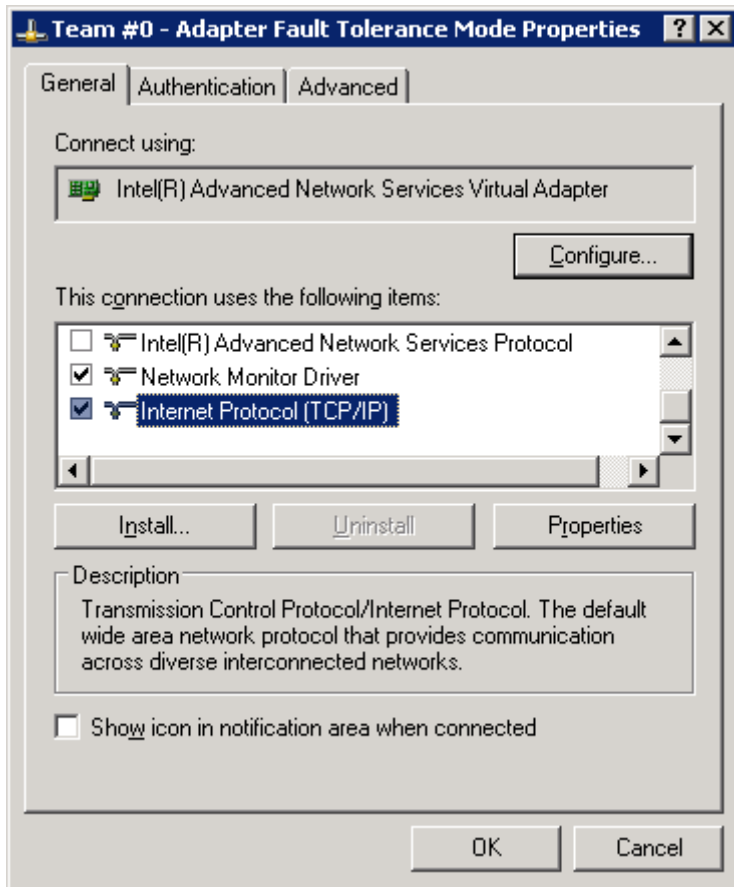**Figure 2-12. Network Connections Window**
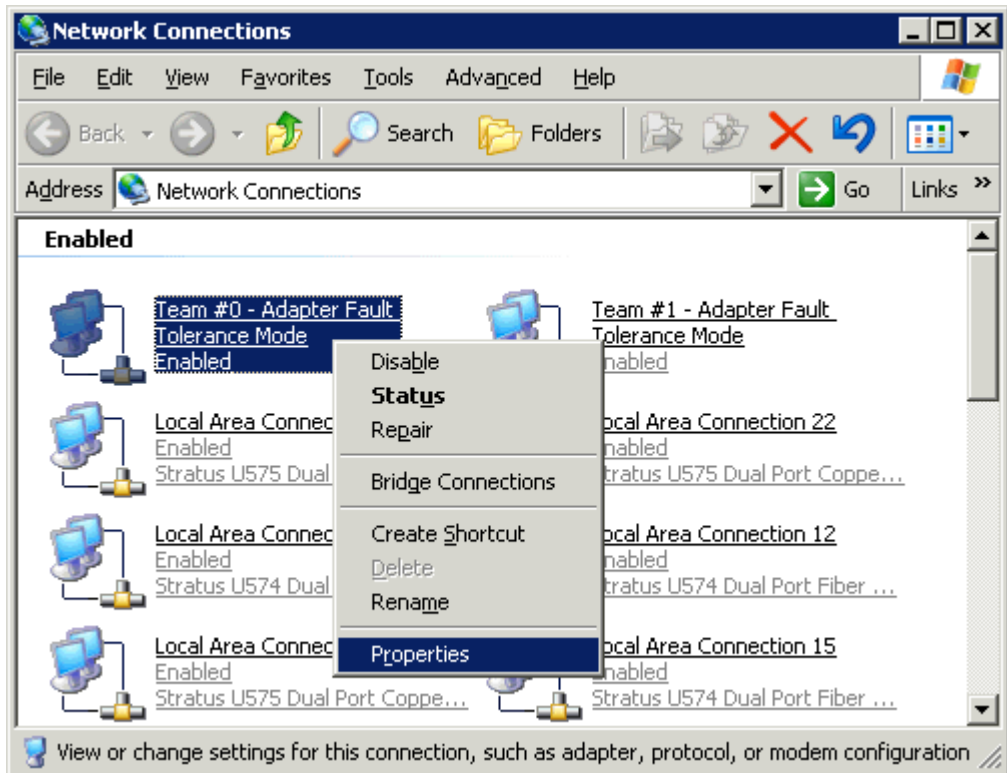
3. In the **Team #*n* Properties** or **VLAN *Name*, ID: *n* Properties** dialog box (see Figure 2-13), click **Internet Protocol (TCP/IP)**, and click **Properties**.

Figure 2-13. Ethernet Team Properties

4. In the **Internet Protocol (TCP/IP) Properties** dialog box (see Figure 2-14), select **Obtain an IP address automatically** or **Use the following IP address**. If you select **Use the following IP address**, enter the IP address, subnet mask, and default gateway. Consult your network administrator for all TCP/IP property settings.

> N O T E
>
> Your TCP/IP property settings must match the configuration of the network to which the team or VLAN is connected. Select **Obtain an IP address automatically** only if the network supports it. If you select it and the network does not support it, the Ethernet PCI adapter may be unusable.

Figure 2-14. Internet Protocol (TCP/IP) Properties
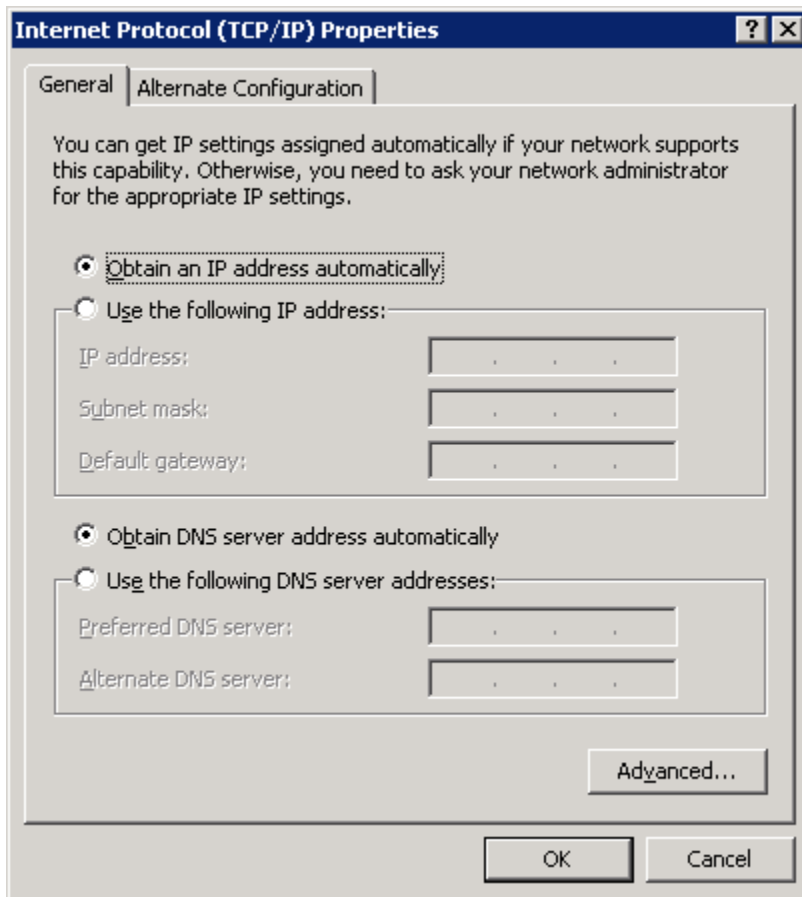
5. Click **OK** to accept the changes.

6. In the **Team #*n* Properties** or **VLAN *Name*, ID: *n* Properties** dialog box, click **Close** to process the new TCP/IP settings and to close the dialog box.

7. Restart PROSet and verify that the new IP address appears in the **Team Configuration** tab for the team or **VLAN Configuration** tab for the VLAN.

Managing Ethernet Teams

The following sections explain how to manage teams with the PROSet utility:

- "Removing Ethernet PCI Adapters from a Team" on page 2-28
- "Adding Ethernet PCI Adapters to a Team" on page 2-31

- "Updating a Team's Ethernet Address" on page 2-32
- "Removing an Ethernet Team" on page 2-34

> N O T E S ——————————————
>
> 1. Anytime you modify an existing team, you might temporarily interrupt the flow of network traffic to the team.
>
> 2. When you add or remove Ethernet PCI adapters in an existing Static Link Aggregation team, the link to the adapters you are adding or removing must be down; otherwise, the switch forwards traffic to the adapters before the configuration is complete.
>
> 3. When you remove or replace a teamed adapter, you might need to reset the Ethernet (MAC) address of the team as described in "Updating a Team's Ethernet Address" on page 2-32. In addition, your network administrator must update any network filtering or security settings that might be based on the MAC address of the Ethernet adapter you removed.

Removing Ethernet PCI Adapters from a Team

> N O T E ——————————————
>
> Remove Ethernet PCI adapters from only one team at a time. Complete the procedure before removing an adapter from another team.

1. Start the PROSet utility if you have not already done so (see "Starting PROSet" on page 2-7).

2. In the left pane of the **Intel(R) PROSet for Wired Connections** dialog box, expand the team and **Member Adapters**.

3. To remove an Ethernet PCI adapter from the team, right-click the adapter and click **Remove from Team** (Figure 2-15).

> N O T E ——————————————
>
> If you select **Remove Adapter** by mistake when you meant **Remove from Team**, click **Cancel** to cancel the changes and to close PROSet, then restart PROSet and start the procedure again. If you apply the changes, use **Scan for Hardware Changes** in **Device Manager** to reinstate the adapter.

Figure 2-15. Removing an Ethernet PCI Adapter from a Team
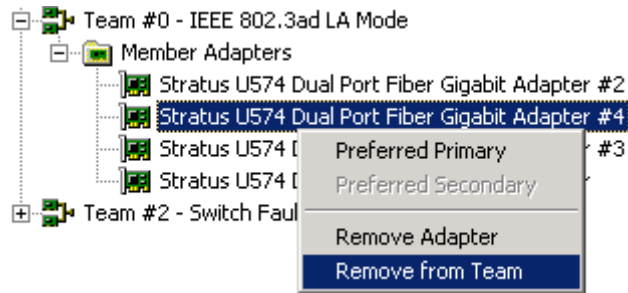
4. A confirmation message appears. If there are only two Ethernet PCI adapters in the team, PROSet warns you about leaving the team with only one adapter (Figure 2-16). Click **OK**.

   Repeat steps 3-4 for each adapter you intend to remove from the team.

Figure 2-16. Confirmation Message: Removing an Ethernet PCI Adapter from a Team
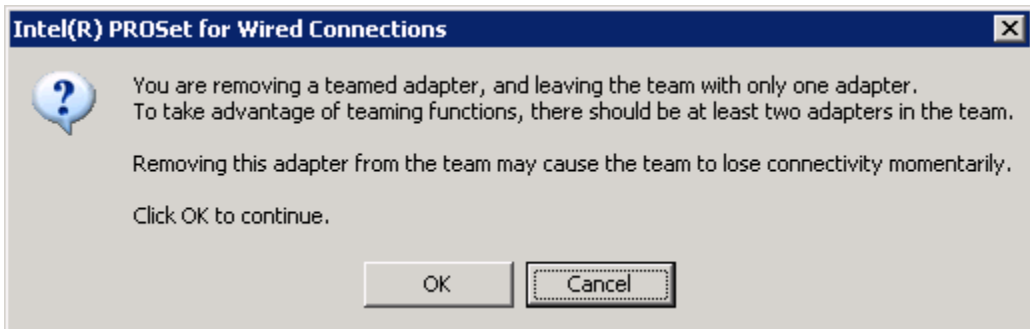
5. When the **Intel(R) PROSet for Wired Connections** dialog box reappears, if necessary, you can manually designate new primary and secondary adapters for the team. See step 7 of "Creating Ethernet Teams" on page 2-18.

   (If you are removing the primary or secondary adapter in the team, PROSet will automatically designate other team members to fill these roles, but you can optionally assign them yourself.)

6. Click **Apply** to process and save the changes.

7. If you are not physically replacing the Ethernet PCI adapters that you removed, update the Ethernet address of the team at this time. See "Updating a Team's Ethernet Address" on page 2-32.

   If you intend to physically replace the adapters you removed, complete the following procedure.

To physically replace adapters in a team

1. In systems with hot-pluggable enclosures, if you intend to maintain network connectivity while removing an enclosure, verify that all active Ethernet PCI adapters in the enclosure are teamed with adapters in another enclosure. See "Locating Ethernet PCI Adapters" on page 2-15 to determine the location of Ethernet PCI adapters in the system.

2. Click **OK** to exit PROSet.

3. Physically remove the Ethernet PCI adapters from the system and install the new adapters. For more information about removing and replacing adapters, see the operation and maintenance guide for your system, as listed in Table 1-2.

   > N O T E ──────────────────────────────
   >
   > If you intend to use the old Ethernet PCI adapters in other systems, do not install them in other systems until you reset the Ethernet address of the team (when you reach step 5 of "Adding Ethernet PCI Adapters to a Team").

4. Start the PROSet utility (see "Starting PROSet" on page 2-7).

5. Remove the entries for the Ethernet PCI adapters that you physically removed from the system. The entries should have an icon with an X to indicate that these adapters are missing (Figure 2-17).

   For each adapter you want to remove, right-click the adapter entry and select **Remove Adapter**. When you are finished, click **Apply** to process the changes.

Figure 2-17. Icon for a Missing (Removed) Adapter
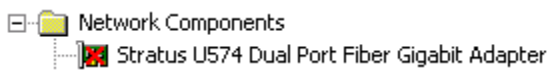
6. Add the new Ethernet PCI adapters to the team, as "Adding Ethernet PCI Adapters to a Team" describes.

Adding Ethernet PCI Adapters to a Team

> N O T E ————————————————————————
>
> Add Ethernet PCI adapters to only one team at a time.
> Complete the procedure before adding an adapter to
> another team.

1. Start the PROSet utility if you have not already done so (see).

2. In the left pane of the **Intel(R) PROSet for Wired Connections** dialog box, right-click the appropriate team. In the menu that appears, click **Add Adapter to Team**, then select the adapter you want to add to the team.

   Repeat this step for any adapters you want to add to the team.

   shows an example of adding a U574 PCI adapter to a team.

Figure 2-18. Adding an Adapter to a Team
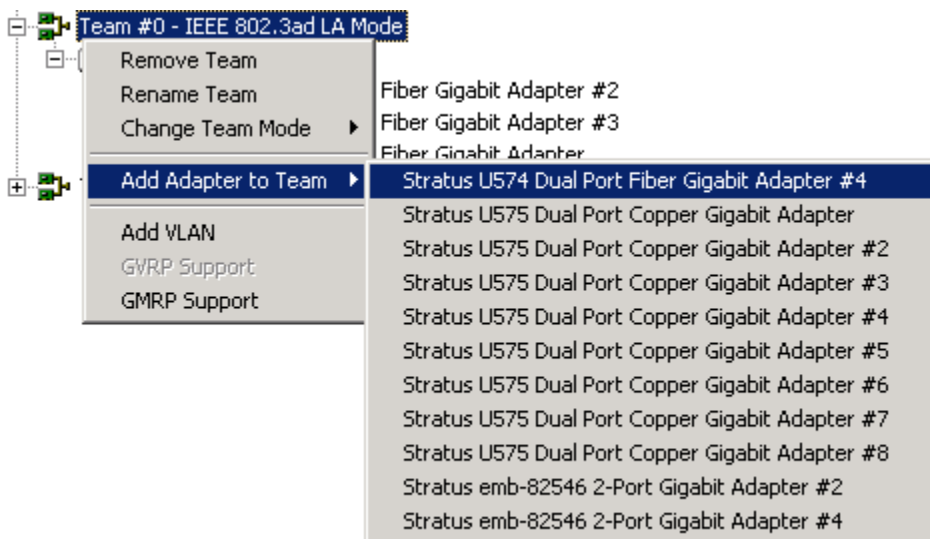
3. If necessary, you can manually designate new primary and secondary adapters for the team. See step 7 of .

   (If you have not previously selected primary or secondary adapters for the team, PROSet will automatically designate adapters to fill these roles.)

4. Click **Apply** to process and save the changes.

5. If necessary, reset the Ethernet address of the team. See "Updating a Team's Ethernet Address" on page 2-32.

6. If you have not already done so, connect the new Ethernet PCI adapters to the network.

7. Verify the configuration of the team. See "Verifying the Configuration of Teams and VLANs" on page 2-23.

Updating a Team's Ethernet Address

When you replace a **primary** PCI adapter, you must assign the correct Ethernet address to the team before you connect the new primary adapter to the network.

Typically, the Ethernet address of a team is the permanent MAC address of the primary adapter. When you replace a primary adapter, the team by default continues to use the MAC address of the adapter you removed. Therefore, after you replace an adapter, you must assign the team an Ethernet address that matches the permanent MAC address of one of the Ethernet PCI adapters currently in the system.

⚠ **C A U T I O N**

The network connection is disrupted when you update a team's Ethernet address.

If necessary, verify that the team's current Ethernet address is identical to the permanent Ethernet address of one of the team members.

To verify the Ethernet address for a team

1. Start the PROSet utility if you have not already done so (see "Starting PROSet" on page 2-7).

2. To obtain the current Ethernet address of a team, click the appropriate team in the left pane of the **Intel(R) PROSet for Wired Connections** dialog box, then click the **Team Configuration** tab. Note the value of **Ethernet Address** under **Team Information** (Figure 2-19).
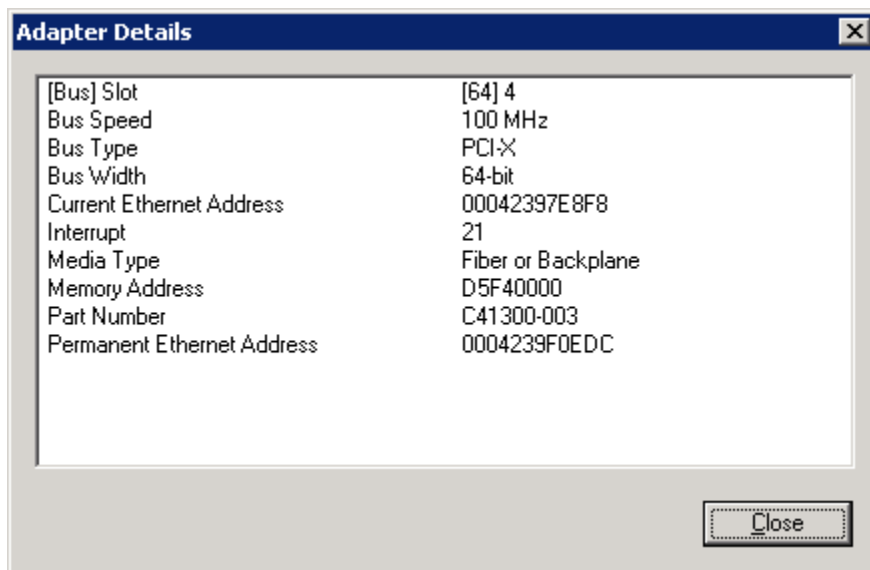
Figure 2-19. Obtaining the Ethernet Address for a Team


```
┌─ Team Information ─────────────────────────────────────────┐
│                                                            │
│  Ethernet Address:     00042397E8F8                        │
│                                                            │
│  IP Address:           169.254.37.188                      │
│                                                            │
│  Team Type:            IEEE 802.3ad Dynamic Link Aggregation│
│                                                            │
│                                                            │
└────────────────────────────────────────────────────────────┘
```
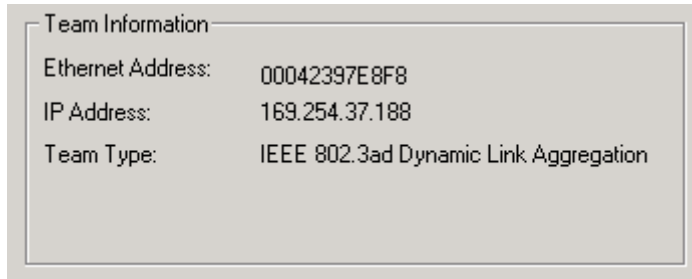
3. To obtain the permanent Ethernet address of each Ethernet PCI adapter, click the adapter in the device tree, click the **General** tab, and click **Adapter Details**. Note the value of **Permanent Ethernet Address** (Figure 2-20).

Figure 2-20. Obtaining the Permanent Ethernet Address of an Ethernet PCI Adapter


```
┌─ Adapter Details ──────────────────────────────────── [X] ─┐
│                                                            │
│  [Bus] Slot                      [64] 4                    │
│  Bus Speed                       100 MHz                   │
│  Bus Type                        PCI-X                     │
│  Bus Width                       64-bit                    │
│  Current Ethernet Address        00042397E8F8              │
│  Interrupt                       21                        │
│  Media Type                      Fiber or Backplane        │
│  Memory Address                  D5F40000                  │
│  Part Number                     C41300-003                │
│  Permanent Ethernet Address      0004239F0EDC              │
│                                                            │
│                                                            │
│                                                            │
│                                                            │
│                                          [  Close  ]       │
└────────────────────────────────────────────────────────────┘
```

Compare the value next to **Permanent Ethernet Address** in the **Adapter Details** dialog box to the **Ethernet Address** of the team, which you obtained in step 2. (According to the information in Figure 2-19 and Figure 2-20, the addresses do not match.) If the value of the team's current **Ethernet Address** does not match the value of the **Permanent Ethernet Address** of one of the Ethernet PCI adapters, update the team's current Ethernet address.

To update the Ethernet Address for a team

1. Start the PROSet utility if you have not already done so (see "Starting PROSet" on page 2-7).

2. In the left pane of the **Intel(R) PROSet for Wired Connections** dialog box, right-click the appropriate team. In the menu that appears, click **Change Team Mode** (see Figure 2-21). Click a mode different from the one with the check mark.

> N O T E
>
> Changing the team mode forces PROSet to update the Ethernet address of the team.

3. Again, right-click the team in the device tree in the left pane, and on the menu that appears, click **Change Team Mode**. Verify that the mode has been changed.

4. Click **OK** to allow PROSet to process the procedure and to close. Allow PROSet about 30 seconds to process the update.

5. Restart PROSet and restore the team to its previous mode.

6. Click **Apply** to process and save the changes. Allow PROSet time to process the update.

Removing an Ethernet Team

> N O T E S
>
> 1. When you remove a team, you lose the connection to the network until you install and configure a new team.
>
> 2. If you assigned a specific IP address to the team, and if you are planning to configure a new team to use the same IP address, note the IP address of the team when you remove it. An assigned IP address is deleted when you remove the team.

To remove a team

1. Start the PROSet utility if you have not already done so (see "Starting PROSet" on page 2-7).

2. In the left pane of the **Intel(R) PROSet for Wired Connections** dialog box, right-click the appropriate team. In the menu that appears, click **Remove Team** (see Figure 2-21).

Figure 2-21. Removing a Team of Ethernet PCI Adapters
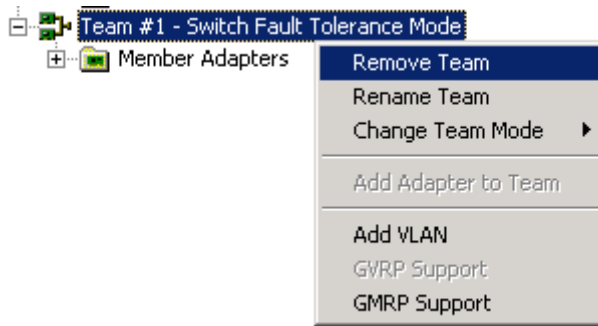
3. A confirmation message appears (see Figure 2-22). Click **OK**.

Figure 2-22. Confirmation Message: Removing a Team

4. When the **Intel(R) PROSet for Wired Connections** dialog box reappears, click **Apply** to process and save the changes.

Troubleshooting Ethernet PCI Adapters

To troubleshoot Ethernet PCI adapters, you can perform general troubleshooting procedures for the systems, and you can perform procedures specific to the Ethernet PCI adapter.

For information about general procedures for troubleshooting your system, see the operation and maintenance guide for your system, as listed in Table 1-2, and the *Express5800/320Ma: System Administrator's Guide*. General procedures include viewing the status of system components in ftSMC and checking for error messages in the event logs.

For information about troubleshooting Ethernet PCI adapters, see the following sections:

Checking Status LEDs

Examine the status LED for each PCI slot of the system to verify that the slots are functioning normally. For more information about interpreting PCI slot status LEDs, see the operation and maintenance guide for your system, as listed in Table 1-2.

If the PCI slots are functioning normally, examine the status LEDs on the individual Ethernet PCI adapters.

The rear of each CPU‑I/O enclosure has two connector ports for the embedded 10/100/1000 Ethernet PCI adapter. Each connector port has two status LEDs, shown in Figure 2-23. Table 2-10 describes the meaning of the embedded Ethernet port status LEDs on the systems.

Figure 2-23. Status LEDs on Embedded Ethernet Ports
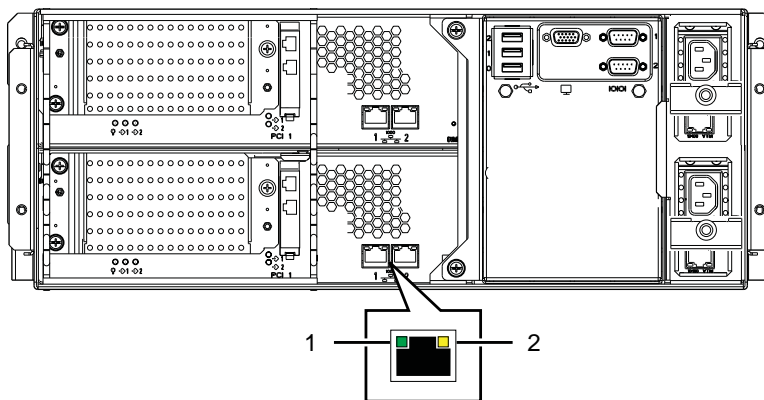
asys029

1   ACT/LINK (Green) LED of the embedded 10/100/1000-Mbps Ethernet port

2   10/100/1000 (Green/Amber) LED of the embedded 10/100/1000-Mbps Ethernet port

Table 2-10. Status LEDs on Embedded Ethernet Ports

LED	Color and State	Meaning
ACT/LINK (Left)	Unlit	Link not present
	Green, steady	Link present
	Green, flashing	Ethernet activity
10/100/1000 (Right)	Unlit	10-Mbps connection
	Green, steady	100-Mbps connection
	Amber, steady	1000-Mbps connection
	Amber, blinking	Identifies the PCI adapter when you click on **Identify Adapter** on the **General** tab in the PROSet utility.

U575 PCI adapters have two status LEDs in each connector port (see Figure 2-1). Table 2-12 describes these LEDs.

Table 2-12. Status LEDs on the U575 PCI Adapter

LED	Color and State	Meaning
ACT/LINK	Green, Steady	The U575 PCI adapter is connected to a valid link partner. The PCI adapter and switch are receiving power, and the cable connection between the switch and the PCI adapter is operational.
	Green, Blinking	The U575 PCI adapter is receiving link pulses.
	Off	The U575 PCI adapter is not receiving link pulses. The PCI adapter and switch are not receiving power, the cable connection between the switch and PCI adapter is not operational, or the driver is not properly configured.
	Amber, Blinking	Identifies the PCI adapter when you click on **Identify Adapter** on the **General** tab in the PROSet utility.
10/100/1000	Off	10 Mbps
	Green, steady	100 Mbps
	Amber, steady	1000 Mbps

Checking Cables of Ethernet PCI Adapters

If your system cannot communicate with the network using a particular Ethernet port, make sure that the Ethernet cable is properly connected to the port and that the ACT/LNK LED on the port is lit. For information about the cables for Ethernet PCI adapters, see "Cabling Requirements of Ethernet PCI Adapters" on page 2-5. Note the following maximum allowable distance between an Ethernet PCI adapter and a switch.

- The maximum distance between a U575 PCI adapter or an embedded Ethernet PCI adapter and a hub or switch is 328 ft (100m).

- The maximum distance between a U574 PCI adapter and a switch is 902 ft (275m).

For U575 PCI adapters or embedded Ethernet PCI adapters configured at 100 or 1000 Mbps, low-quality cables might cause signal integrity problems. If a connection using either of these Ethernet PCI adapters fails to operate at 100 or 1000 Mbps, you can determine if the cable is at fault by using the same cable but resetting the data rate to 10 Mbps. For more information, see "Configuring Link Speed and Duplex Mode" on page 2-16.

You can also run diagnostic tests on cables. For more information, see "Using PROSet Utility Diagnostics" on page 2-41.

Verifying Link Data Rate and Mode

If a problem persists when the network cables are properly attached and the distances are within acceptable limits, examine the data rate and duplex mode (full or half) of each Ethernet PCI adapter and its link partner. Verify that these values are appropriate and that they are supported by both the adapter and the link partner.

For more information, see "Configuring Link Speed and Duplex Mode" on page 2-16.

Checking the Network Statistics

If there is a viable link between each Ethernet PCI adapter and its link partner, but network connectivity is still intermittent, check the network statistics for the individual adapters and associated teams to see if there are any errors.

Look for the network statistics in the **Network Driver** tab of a particular adapter or team in the PROSet utility (Figure 2-24).

Figure 2-24. Network Statistics in PROSet
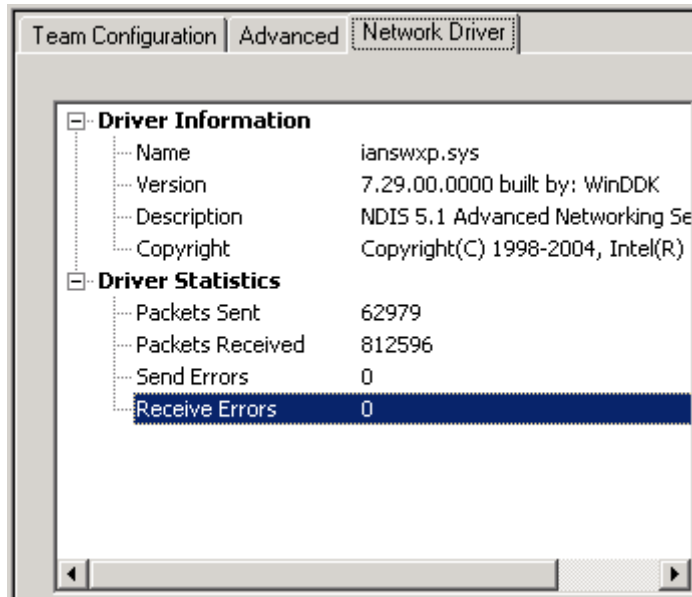
You can also find network statistics for **unteamed** adapters in ftSMC. The statistics are located in **Performance Counters** under the **Ethernet Controller** node (Figure 2-25).

Figure 2-25. Network Statistics in ftSMC
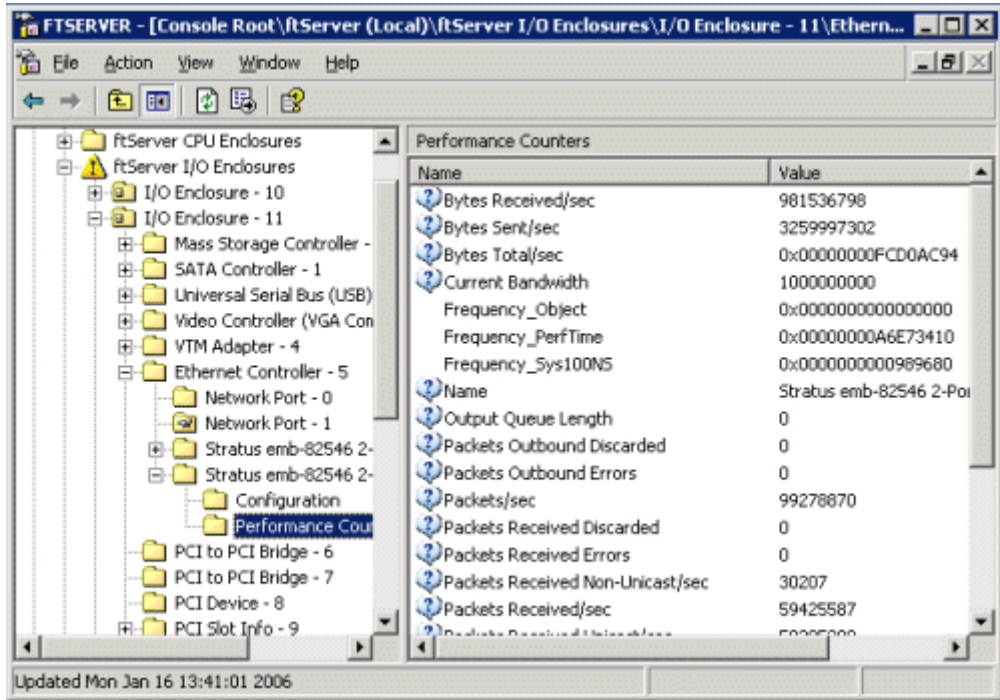
If PROSet or ftSMC indicate high error counts, try running diagnostic tests in PROSet to locate the problem.

Using PROSet Utility Diagnostics

Use the PROSet utility to run diagnostic tests on Ethernet connections, cables, and hardware.

NOTES

1. Running **Hardware** diagnostic tests on the primary adapter in an AFT or SFT team stops network traffic until the secondary PCI adapter takes over. Running **Hardware** diagnostics on the secondary adapter could reduce throughput. Running **Hardware** diagnostics on an unteamed PCI adapter stops network traffic during the entire test.

2. By default, the system software installation enables logging of **Hardware** diagnostics in the PROSetDiagLog.Log file, which is located in C:\Program Files\Stratus\Management\Logs. You do not need to modify the Windows registry to enable this feature, as specified in the PROSet online help.

To start PROSet Utility diagnostics

1. Start the PROSet utility if you have not already done so (see "Starting PROSet" on page 2-7).

2. In the left pane of the **Intel(R) PROSet for Wired Connections** dialog box, click an individual Ethernet PCI adapter or an adapter that is part of a team.

3. In the right pane, click the **General** tab, then click **Diagnostics**.

4. In the **Diagnostics** dialog box, click the **Connection**, **Cable**, or **Hardware** tab for the appropriate test (Figure 2-26).

5. Click **Run Test**. The test results are displayed in the **Diagnostics** dialog box.

Figure 2-26. PROSet Diagnostics
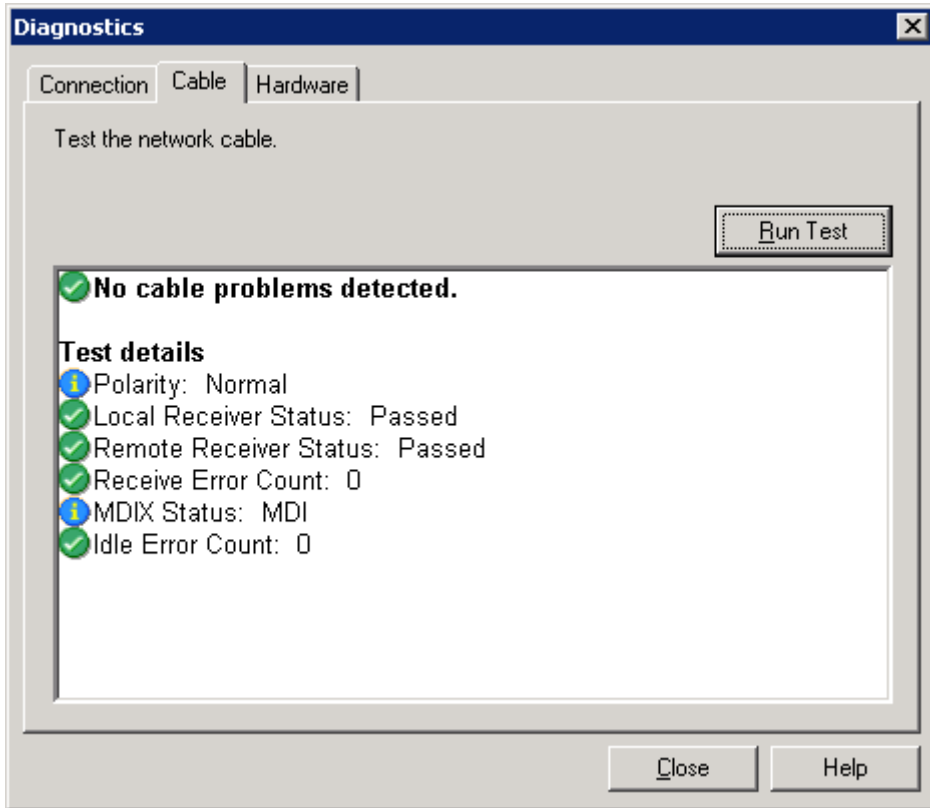
If network connectivity problems persist, try replacing the associated Ethernet PCI adapter(s). If that does not correct the problem, contact your authorized Service Representative.

Chapter 3
U525 and U526 Optical Fibre Channel PCI Adapters

The following 64-bit, 66-MHz PCI host bus adapters (HBAs) provide connections to most EMC CLARiiON or Symmetrix storage systems:

- The U525 Optical Fibre Channel PCI Adapters provide 2-gigabit (Gb) attachment to the storage system through a Storage Area Network (SAN) or switch. The AA-U52500 is a high-profile adapter and the AA-U52510 is a low-profile adapter.

- The U526 Optical Fibre Channel PCI Adapters provide 2-Gb direct attachment to the storage system. The AA-U52600 is a high-profile adapter and the AA-U52610 is a low-profile adapter.

> N O T E
>
> For information about the 64-bit, 133-MHz U531 Optical Fibre Channel PCI Adapter, which supports the EMC CLARiiON AX100 Storage System, see *Attaching an EMC CLARiiON AX100 Storage System to an Express5800/320Ma System*.

For a summary of the general features and requirements of optical Fibre Channel PCI adapters, see Table 3-1. For an illustration of the faceplate of an optical Fibre Channel PCI adapter, see Figure 3-1.

The following sections provide detailed information about optical Fibre Channel PCI adapters:

- "Hardware Requirements of Optical Fibre Channel PCI Adapters" on page 3-3
- "Software Requirements of Optical Fibre Channel PCI Adapters" on page 3-4
- "Cabling Requirements of Optical Fibre Channel PCI Adapters" on page 3-5
- "Configuring Optical Fibre Channel PCI Adapters" on page 3-6
- "Installing Optical Fibre Channel PCI Adapters" on page 3-6
- "Updating the Driver for Optical Fibre Channel PCI Adapters" on page 3-7
- "Troubleshooting Optical Fibre Channel PCI Adapters" on page 3-9

For information about your EMC storage system, see the EMC documentation supplied with your storage system. For additional information about the optical Fibre Channel PCI adapters, contact Technical Support (866-269-1239).

Table 3-1. Optical Fibre Channel PCI Adapters Features and Requirements Summary

Feature/Requirement	Description
Adapter Type	Optical Fibre Channel PCI adapter (for connection to EMC CLARiiON and Symmetrix storage systems only)
Part No.	AA-U52500 or AA-U52510 (for 2-Gb connections to the storage system through a SAN or switch) AA-U52600 or AA-U52610 (for 2-Gb direct connections to a storage system)
Supported systems	AA-U52500: Express5800/320Ma 3.2 GHz, 3.6 GHz,[†] Dual-Core systems AA-U52510: Express5800/320Ma 3.2 GHz, 3.6 GHz, Dual-Core systems AA-U52600: Express5800/320Ma 3.2 GHz, 3.6 GHz,[†] Dual-Core systems AA-U52610: Express5800/320Ma 3.2 GHz, 3.6 GHz, Dual-Core systems
Required/Optional	Optional
Slot Assignment	AA-U52500 and AA-U52600: Fits only in full-height PCI slots AA-U52510 and AA-U52610: Fits in low-profile or full-height PCI slots
Cable Requirements	Fibre Channel optical cable (provided by EMC)

† To provide the necessary full-height PCI slots in an Express5800/320Ma 3.2 GHz system, you must install the AK533 attachment kit. See the *Express5800/320Ma: Operation and Maintenance Guide* for more information.

Figure 3-1. Faceplate of an Optical Fibre Channel PCI Adapter
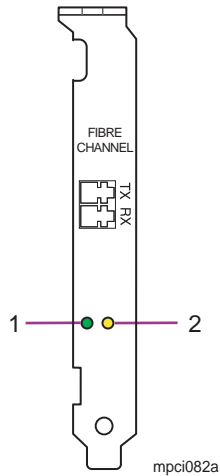
1   Green status LED

2   Amber status LED

Hardware Requirements of Optical Fibre Channel PCI Adapters

Optical Fibre Channel PCI adapters are optional. Table 3-2 lists the maximum number of optical Fibre Channel PCI adapters in each system.

Table 3-2. Maximum Numbers of Optical Fibre Channel PCI Adapters

System	Maximum Number of Optical Fibre Channel PCI Adapters
Express5800/320Ma 3.2 GHz and 3.6 GHz, Dual-Core	2 U525 PCI adapters, part number AA-U52500 or AA-U52510 or 2 U526 PCI adapters, part number AA-U52600 or AA-U52610

You can install full-height PCI adapters only in slot 2 or slot 3. (To provide the necessary slots in an Express5800/320Ma 3.2 GHz system, you must install the AK533 attachment kit. See the *Express5800/320Ma: Operation and Maintenance Guide* for more information.)

Connect two, paired, optical Fibre Channel PCI adapters from each system to a storage array (for U526 PCI adapters) or to a SAN or switch (for U525 PCI adapters). Paired PCI adapters occupy paired slots in different enclosures. For example, PCI slots 10/1 and 11/1 are paired slots.

Software Requirements of Optical Fibre Channel PCI Adapters

To function properly, optical Fibre Channel PCI adapters require a QLogic QLA2310 driver and other software updates approved by EMC. The adapters also require EMC PowerPath software, which comes with your EMC storage system.

To prepare for installing the optical Fibre Channel PCI adapters, you need to perform the following tasks:

- Go to the EMC Web site to determine the latest adapter driver and other required software updates approved and qualified by EMC for Express5800/320Ma systems.

- Download the adapter driver and extract it from the compressed archive file.

- Download and extract any other required software updates.

The EMC Support Matrix for the storage system provides information about the latest qualified adapter driver and any additional required software updates. To access the EMC Support Matrix, go to the EMC Web site.

To check for the latest approved and qualified driver

1. Point your browser to http://www.emc.com/interoperability.

   (If the **Interoperability** Web page fails to load, navigate to the product support page for your storage system.)

2. Find the link for the **EMC Support Matrix**, and download this file in PDF format.

3. Open the EMC Support Matrix PDF file. In **Bookmarks**, expand one of the following headings:

   - **Symmetrix 8000 Series**

   - **Symmetrix DMX Series**

   - **CLARiiON FC4700**

   - **CLARiiON CX-Series**

4. Expand **Base Connectivity**, expand **Microsoft Windows 2003 [x86]**, and double-click Express5800/320Ma.

5. In the footnotes for the table, make note of the Driver Version entry, which specifies the driver version number for the optical Fibre Channel PCI adapter. Other entries document the supported releases of Express5800/320Ma System Software, required hotfixes from Microsoft, and other relevant information.

Download the driver for the optical Fibre Channel PCI adapters and any other required software updates from the locations specified in the EMC Support Matrix **before** you install the adapters.

N O T E S

1. If the EMC Support Matrix points to the QLogic Web site for the latest adapter driver, search for the driver under the QLogic product name for the adapter.

2. If you need to upgrade the NVRAM (nonvolatile RAM) on the optical Fibre Channel PCI adapter, contact NEC Technical Support or your authorized Service Representative.

Cabling Requirements of Optical Fibre Channel PCI Adapters

Each optical Fibre Channel PCI adapter requires a Fibre Channel optical cable, which is supplied with the storage system.

⚠ W A R N I N G

When fiber-optic connectors are not connected, place the connector covers over the fiber-optic connectors to prevent injury to eyes or skin.

N O T E

Label each cable that you attach to a PCI adapter, noting the host name, I/O element number, PCI slot number, and port number (if applicable) to which the cable connector attaches.

At one end, the Fibre Channel optical cable has an LC connector (male), which attaches to the optical Fibre Channel PCI adapter itself. Figure 3-2 illustrates an LC connector (male). The connector at the other end of the cable depends on the model of the CLARiiON or Symmetrix storage system that EMC supplies. The correct type of cable is supplied with the storage system.

Figure 3-2. LC Connector of a Fibre Channel Optical Cable
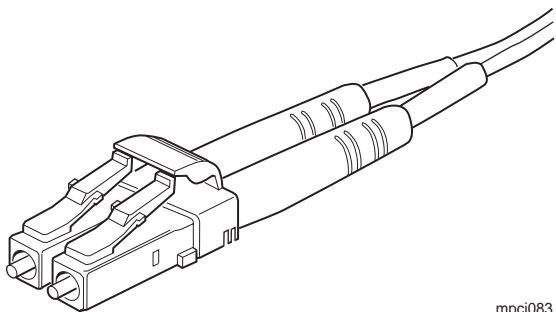
mpci083

Configuring Optical Fibre Channel PCI Adapters

The manufacturer configures the internal settings for each optical Fibre Channel PCI adapter before the adapters arrive at your site. The U525 PCI adapters are configured to attach to a SAN or switch. The U526 PCI adapters are configured to attach directly to a storage system.

For information about configuring the EMC storage systems, see the EMC documentation supplied with the storage system.

Installing Optical Fibre Channel PCI Adapters

Before installing the optical Fibre Channel PCI adapters, you must download the required driver and software updates from the Web as described in "Software Requirements of Optical Fibre Channel PCI Adapters" on page 3-4.

> N O T E
>
> If you are installing optical Fibre Channel PCI adapters in a production system, you must schedule downtime for the following procedure. Though it is possible to remove the I/O enclosures from certain systems and physically install the adapters without shutting down the entire system, you must still reboot the system when you install the EMC PowerPath Software and any applicable software updates.

To install the adapters

1. Install any applicable Microsoft hotfix software updates required by the storage system.

2. Shut down the system.

3. Physically install the optical Fibre Channel PCI adapters.

   For more information about this procedure, including pertinent safety and electrostatic discharge precautions for working inside an I/O enclosure, see the operation and maintenance guide for your system, as listed Table 1-2.

4. Connect the optical Fibre Channel cables. For more information, see "Cabling Requirements of Optical Fibre Channel PCI Adapters" on page 3-5.

5. Boot the system. When the operating system loads, it automatically installs a driver for the optical Fibre Channel PCI adapters.

6. To ensure that you have the latest approved driver, update the driver for both optical Fibre Channel PCI adapters. See "Updating the Driver for Optical Fibre Channel PCI Adapters" for more information.

7. If applicable, install the EMC PowerPath utility on your system and reboot.

8. Configure the storage system and assign storage devices to your system.

For more information about installing the EMC PowerPath utility and configuring the storage system, see the documentation set for the storage system.

N O T E —————————————————————

To allow the Optical Fibre Channel PCI adapters for your EMC Symmetrix RAID storage system to duplex under Express5800/320Ma System Software Release 3.0.0 or higher, you must enable the CBIT (Common Serial Number) on the Symmetrix director ports connected to your system. For further information, contact your EMC representative.

Updating the Driver for Optical Fibre Channel PCI Adapters

Use the following procedure to update the driver for the optical Fibre Channel PCI adapters after you physically install the adapters, or anytime the driver needs an update.

For information about obtaining the driver, see "Software Requirements of Optical Fibre Channel PCI Adapters" on page 3-4.

To update the driver using Device Manager

1. Access Device Manager. For example:

    a. On the **Start** menu, right-click **My Computer**. Then, click **Manage** on the shortcut menu.

    b. In the left pane of **Computer Management**, under **System Tools**, click **Device Manager**.

2. In **Device Manager**, expand **SCSI and Raid Controllers**.

3. In the list of adapters, right-click the name of the appropriate optical Fibre Channel PCI adapter. (Device Manager displays the name of these adapters as **QLogic Fibre Channel Adapter,** or a similar name). Then, click **Properties** on the shortcut menu.

4. In the **Properties** window, click the **Driver** tab; then click **Update Driver**.

5. Follow the instructions in the **Hardware Update Wizard** until the **Install from a list or specific location** option is displayed. Click this option to select it, then click **Next**.

6. Click **Don't search. I will choose the driver to install,** then click **Next.**

7. In the **Select a Device Driver** window, click **Have Disk**.

8. Browse to the location where you saved the QLogic driver and select the file that is discovered (oemsetup.inf). Then, click **Next**. Windows installs the driver.

9. Click **Finish** to complete the installation. Repeat steps 3 through 9 to update the driver for the second adapter.

10. Reboot the system.

11. In either Device Manager or ftSMC, verify that the driver is loaded. For information about ftSMC, see the *Express5800/320Ma: System Administrator's Guide*.

To check the driver using Device Manager

1. Access **Device Manager**. For example:

    a. On the **Start** menu, right-click **My Computer**. Then, click **Manage** on the shortcut menu.

    b. In the left pane of **Computer Management**, under **System Tools**, click **Device Manager**.

2. In **Device Manager**, expand **SCSI and Raid Controllers**.

3. In the list of adapters, right-click the name of the appropriate optical Fibre Channel PCI adapter. (Device Manager displays the name of these adapters as **QLogic Fibre Channel Adapter**, or a similar name.) Then, click **Properties**.

4. In the **Properties** window, click the **Driver** tab. Then, click **Driver Details**.

Troubleshooting Optical Fibre Channel PCI Adapters

To troubleshoot an optical Fibre Channel PCI adapter, you can perform general troubleshooting procedures for the system and procedures specific to the optical Fibre Channel PCI adapter.

For information about general procedures for troubleshooting your system, see the operation and maintenance guide for your system, as listed in Table 1-2, and the *Express5800/320Ma: System Administrator's Guide.* General procedures include viewing the status of system components in ftSMC and checking for error messages in the event logs.

To troubleshoot optical Fibre Channel PCI adapters specifically, do the following:

- Make sure that the optical Fibre Channel cable from the PCI adapter to the disk drive is properly connected. For information about the optical Fibre Channel cable, see "Cabling Requirements of Optical Fibre Channel PCI Adapters" on page 3-5. If the problem persists when the cable is properly attached, replace the cable. If replacing the cable does not fix the problem, contact NEC Technical Support or your authorized Service Representative.

- Examine the status LED for each PCI slot and the LEDs on each optical Fibre Channel PCI adapter.

  For more information about interpreting the PCI slot LEDs, see the operation and maintenance guide for your system, as listed in Table 1-2.

  Each optical Fibre Channel PCI adapter contains two status LEDs (see Figure 3-1). For descriptions of these LEDs, see Table 3-3.

Table 3-3. Status LEDs on the Optical Fibre Channel PCI Adapter

Green	Amber	Meaning
On	On	The adapter is powering up but is not yet operational.
On	Off	The adapter is operational: it has power and the firmware is loaded.
Off	On	The adapter has a signal.
Off	Flashing	Loss of synchronization; connection is not operational.
Flashing	Flashing	Firmware error.

Appendix A
Converting Adapters for Low- and High-Profile PCI Slots

If you order and receive certain PCI adapters separately from the system, you may need to convert them from a low-profile adapter to a high-profile adapter, or from a high-profile adapter to a low-profile adapter. The following procedure describes how to perform the conversion.

To convert a PCI adapter to a low- or high-profile adapter

1. Remove the two screws that secure the faceplate to the adapter (see Figure A-1).

2. Use the same screws to secure the appropriate faceplate to the adapter (see Figure A-1).

Figure A-1. Removing and Installing Low- and High-Profile Faceplates

asys074

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